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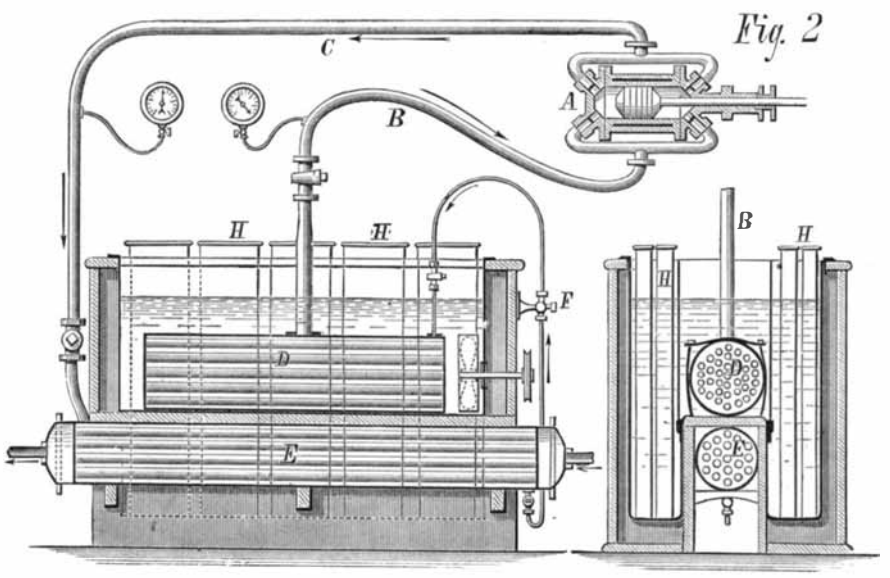
THE PICTET ICE MACHINE.

Ice machines are commonly classed with reference to the mediums they employ for abstraction of heat, hence they are distinctively known as air machines, ether machines, ammonia machines, and so on. A more logical and simpler classification, however, is to refer them to but two general classes, namely, machines which involve the use of a volatile liquid or freezing mixture, and those which do not. Under the first heading would be grouped ammonia, ether, and like machines, under the latter only those wherein air is compressed, then cooled without expansion, and finally expanded, thus causing the abstraction of large quantities of heat. It is not deemed necessary here to enter into the relative advantages and disadvantages of these various different devices, inasmuch as the subject is open to considerable argument on both sides.

The ice machine, or rather the system of artificial refrigeration, invented by M. Raoul Pictet, is based upon the refrigerating properties of anhydrous sulphurous oxide. This substance is a colorless liquid having a specific gravity of 1·6, and remaining fluid under a pressure of from 2 to 3 atmospheres. When allowed to escape in air it vaporizes rapidly, producing a decrease of temperature of 135° Fah., and if a teaspoonful of the liquid be placed in a wine glass of boiling water, the latter instantly freezes solid. It is imported from Europe in copper cylinders each holding about 200 lbs., and the cost of the material delivered in New York is about 65 cents a pound.

The manner in which the system operates will be clearly understood from Fig. 2, which represents the disposition of a small apparatus, such as is illustrated in Fig. 3. At A is the compression pump, the valves of which are so arranged that at one stroke the gaseous oxide is aspirated through the tube, B, and on the return it is compressed through the tube, C. Tube B connects with the refrigerator, D; tube C with the condenser, E. The oxide is introduced at the plug lock, F, and is drawn by the pump in the direction of the arrow into the copper tubular refrigerator, D, the liquid filling the space between the tubes. Here vaporization and consequent production of intense cold takes place, and the temperature of the non-congealable mixture of glycerin and water which surrounds the refrigerator is so far reduced that water placed in the metal boxes, H, immersed in the tank becomes rapidly frozen. The propeller wheel, shown on the right, determines a current of the glycerin solution through the tubes and thus hastens the refrigeration. The vapor of the oxide is drawn out of the refrigerator, as already noted, by the pump, carried through the latter, and forced into the space between the tubes of the condenser, E. Through the tubes a cold stream of water is constantly pumped, which determines the condensation of the vapors, and the re-liquefied oxide passes into the admission pipe and once more enters into circulation as already described.

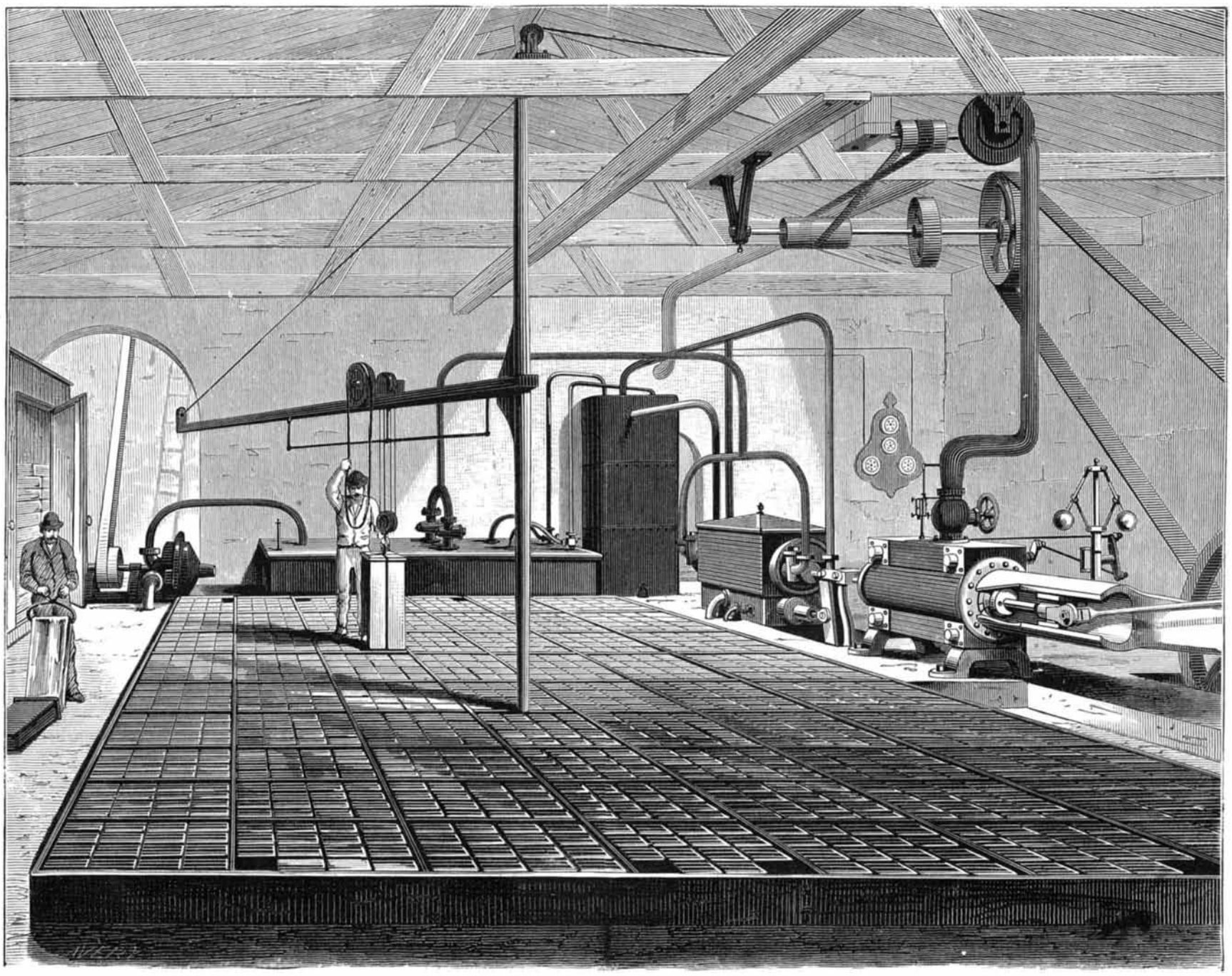
Fig. 2



THE PICTET ICE MACHINE.

In the large illustration, Fig. 1, is represented the arrangement of machinery now in operation in this city. Here the freezing tank, which is very large, is separate from the conden-

[*Continued on page* 338.]



THE PICTET ICE MACHINE.—Fig. 1.

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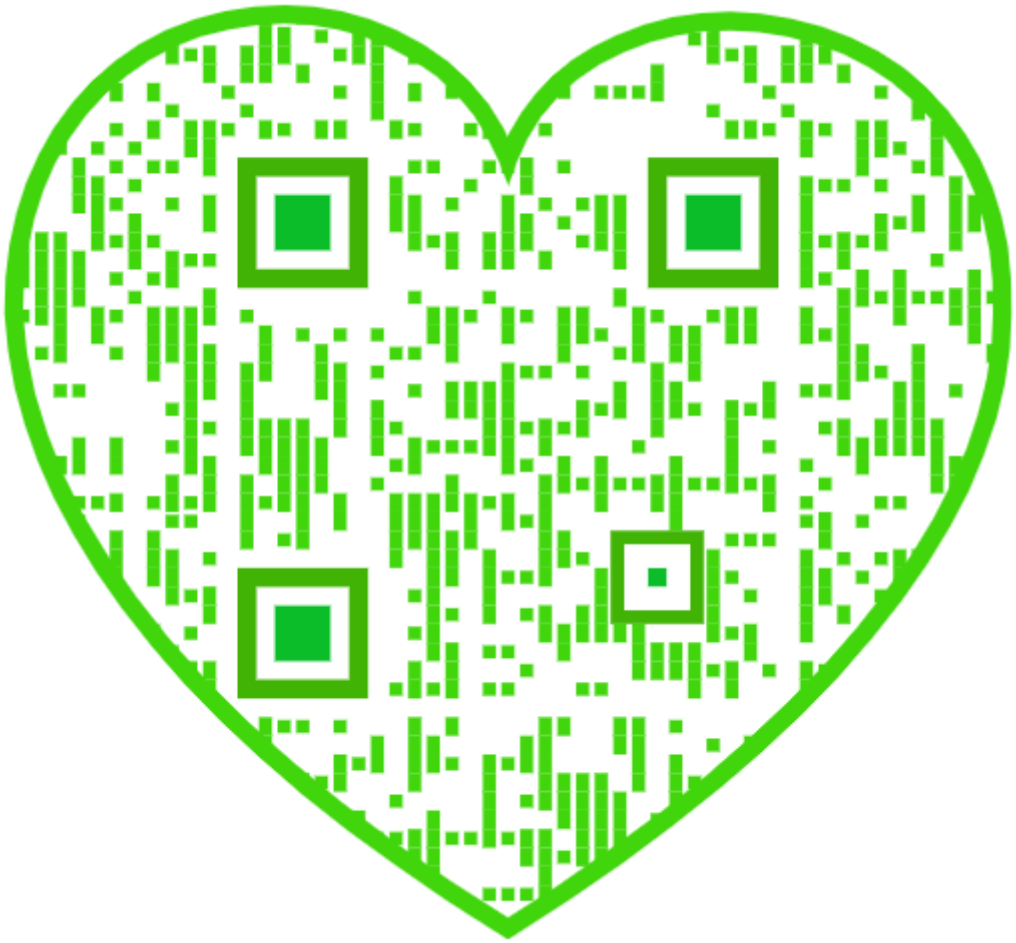

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THE CURE OF DIPHTHERIA.

Dr. E. N. Chapman, of Brooklyn, N. Y., has discovered an antidote to the poison of diphtheria, by which the percentage of deaths is reduced to less than one in fifty. Statistics show that the percentage of recoveries in cases treated under the usual practice is about thirteen, or eighty-seven out of a hundred sufferers succumb to the fell disease.

Diphtheria first appeared in this country in 1858. Dr. Chapman, in 1859, lost several cases, and became distrustful of the regular methods. He had been using alcohol in the cure of ship-fever, and he determined, though contrary to all rules, to try it in diphtheria. To his surprise, several of his patients recovered. He then tried quinia, and found it acted well, but not so quickly. At last he settled on a combination of the two, alcohol and quinia, and with these remedies, he claims that diphtheria is more amenable to treatment than many common diseases. In an epidemic, such as diphtheria, all are affected by the morbific agent; but a few only yield to it. Mature, vigorous persons have vitality enough to resist the disease. Children and weakly adults are its usual subjects. Dr. Chapman considers that there is, almost always, super-added a local and direct exciting cause, such as defective exercise, improper diet, dark rooms, damp houses, imperfect ventilation, and poisonous emanations from decomposing filth in privies, cesspools, sewer pipes, etc. To such agencies the strongest constitution will soon succumb. The blood being deteriorated, its crasis is impaired and its vitality lowered; and then the sympathetic nerves, failing to receive due stimulus, waver in their efforts to carry on the animal functions.

"All local treatment," he says, "is worse than useless. It exhausts the nerve force and induces greater injection of the blood vessels, thus favoring the exudation.

"Alcohol neutralizes the diphtheritic poison, sets free the nerves of animal life, subdues the fever and inflammation, destroys the pabulum that sustains the membrane, cuts short the disease, conquers its sequelæ, and shields other members of the family from an attack. Upon the subsidence of the fever, as is usually the case in from twenty-four to thirty-six hours, a purulent secretion begins to loosen the membrane, and soon, thereafter, to detach it in flaky, ragged fragments. This process may take place, and recovery be possible, even when the larynx and trachea are implicated. The membrane is seldom renewed, when this secretion is maintained by a steady use of the remedy. Alcohol is as antagonistic to diphtheria as belladonna to opium, or quinia to malaria. Like any other antidote, it must be given promptly at the outset, or otherwise its potency will be lessened, perhaps lost altogether.

"Alcohol does not act as a stimulant, nor induce any of its ordinary effects. Enough may be given to cause profound intoxication in health, and yet there exists no signs of excitement or odor in the breath."

Quinia is an efficient alloy to alcohol. It energizes the ganglionic nervous system, and thus enables the organism to right itself and resume its function.

Dr. Chapman sustains his position by citing numerous cases in which this treatment was successful. He states that, in his long experience, he only knew of one case where a drunkard had diphtheria. He generally gives the alcohol in the form of whiskey.

THE GEOLOGICAL RELATIONS OF THE ATMOSPHERE.

The gaseous envelope which surrounds our globe plays a very considerable part in the chemical changes ever going on in rock formations, whether actually at the surface—as in what is called the "weathering of rocks"—or in the less apparent, but perhaps more powerful, action carried on below the surface. In a late number of the *Quarterly Journal of Science*, Edward T. Hardman, F.C.S., has a very exhaustive paper on "The Atmosphere Considered in its Geological Relations," from which we extract the following interesting facts:

Perfectly pure water has a very appreciable solvent effect on rocks, which is immensely augmented when it is chemically charged with carbonic acid, oxygen, nitric acid, and other matters derived directly or indirectly from the atmosphere. But while on the one hand the influence of the atmosphere disintegrates and destroys rock masses, on the other it is mighty in building them up. Without the small percentage of carbonic acid contained in the air there could be no vegetation, and there would be none of the coal beds which form such important members of our rock formations. The immense masses of limestone found everywhere, and the coral reef of the present day, must owe their being indirectly to the carbonic acid of former atmospheres. A drop of rain water absorbs a trace of carbonic acid from the atmosphere, falls on a rock containing lime in some form, dissolves the lime as bicarbonate, carries it down to the ocean, and finally gives it up to become part of the skeleton of a coral or mollusc, which in its turn may form a portion of an immense mass of limestone rock.

The bulk of the atmosphere is made up of oxygen and nitrogen, but these do not take so active shares in geological matters as the almost infinitesimal trace of carbonic acid present. The amount ranges from 3 to 10 volumes in 10,000 volumes of air. The principal sources of increase are, volcanic and other subterranean exhalations; respiration of animals; combustion of fuel and vegetable decay.

The series of rock-metamorphisms due to the simple absorption of carbonic acid by a plant is very interesting. The carbon is assimilated by the plant, and it dies and becomes thus a part of a coal bed or lies embedded in sediment of some kind. Decomposition sets in; and if there be a reducible compound near it, chemical changes result. If the strata contains sulphate of iron, it is reduced to sulphide, commonly known as iron pyrites or false gold. The reduction is effected by the carbon of the plant abstracting the oxygen from the sulphate. The resulting carbonic acid either is taken up by percolating water and penetrates farther into the heart of the rock, effecting new changes, or it finds its way to the surface through some crevice, or by aid of a mineral spring, and once more mingles with the the atmosphere, to be perhaps again absorbed by vegetation and pass through a similar round of changes afresh. In many cases the action of the carbonic acid changes a metallic ore from an insoluble to a soluble compound, thus reducing the ancient crystalline rocks. The metals carried away by streams were deposited along their beds, and valuable beds of ore were formed.

The atmosphere in the carboniferous age contained a much larger portion of carbonic acid. This has been gradually absorbed into the earth, until the amount stored in the earth is estimated at 6,620 times as much as there is in the atmosphere, although the latter contains 1,250,000,000,000 tons of carbon. All animal carbon is derived from the atmosphere. Say a tiger dines off a cow, the carbon and nitrogen of her flesh have been obtained from vegetation, which in turn extracted them from the air; so that we have a kind of physiological "House that Jack built," "This is the Tiger that ate the Cow that devoured the Grass that absorbed the Carbon," etc.

Any considerable difference in the volume of carbonic acid must result in diminution of animal life. Very little above the ordinary standard carbonic acid in air becomes a deadly poison to all warm-blooded animals. If diminished vegetable life would languish, graminivorous animals would die of starvation, and finally the carnivora, being obliged to prey upon each other, would of course become extinct. The result would be a completely barren and desolate planet, perhaps in some degree resembling the moon.

Oxygen is the next in importance as a geological agent. Percolating in rocks, dissolved in rain water, it quickly reacts on all oxidizable substances. Carbonates and protosalts are converted to peroxides; sulphides are changed into sulphates, and sometimes alums are formed.

Carbon and oxygen are thus antagonistic in their action on rocks and minerals, and are thus keeping up a circulation between the earth and the air. The carbon always reduces the oxides, and the oxygen replaces the carbonic acid of carbonates with the same inveteracy.

The ammonia existing in the air is absorbed by plants, and by their decomposition forms nitrates. "And now," Mr. Hardman says in conclusion, "it will be seen what an all-powerful agent the atmosphere we breathe is. Without its aid we should know never a stratified formation, and would simply form a ball of truly primitive rock. We should have no coal, no metalliferous deposits, no rivers or seas, and no rain—consequently no denudation by rain and rivers—for the vapor of waters could not ascend into empty space. We should have—but, last and worst of all, there would be no "we." Life would be impossible, and the earth would finally degenerate into a pale-faced moon." That this is probably her mission cannot be denied; and probably before Saturn and Jupiter have cooled down to a habitable temperature, the senescent earth will roll through space—cold, void, and airless.

VENERABLE JOURNALISTS.

In the December issue of *Godey's Lady's Book* appear the valedictories of both the editor and the publisher of that magazine, which with the beginning of the new year is to pass into other hands. Much has been written and said about the exhaustive nature of the journalist's profession, and the general deduction has been made that as a rule literary people are neither long-lived nor are they able to withstand the mental labor incumbent upon them, over any very extended periods of years, comparison being had with members of other callings. No better examples demonstrating the contrary of the commonly accepted opinion could be found than in the careers of Mrs. Sarah Josepha Hale and Mr. L. A. Godey. Mrs. Hale states that she began the editing of the *Ladies' Magazine*, in 1827—fifty years ago—nine years later that periodical was consolidated with the *Lady's Book*, of which Mrs. Hale assumed the editorship, the active duties of which she has subsequently continuously performed. A half century of steady journalistic labor is in itself phenomenal, more so when it be considered that a woman has accomplished the task and it becomes still more remarkable when we are told that it has been done not early, but late in life, Mrs. Hale now having attained the venerable age of 90 years. Certainly no one would imagine that the editor of the sprightly periodical before us, a journal which pre-eminently deals with fashion and art, and is addressed especially to the young, is the same editor who wrote in the same brilliant way and made up the same interesting papers for our grandmothers, but the fact remains that she of late years has been writing for a third generation of readers. The same is true of Mr. Godey, although he is a mere youth as compared with Mrs. Hale, being but seventy three years of age. He began literary work when but fifteen years old, and hence his journalistic life has extended over fifty-eight years, during all but the first ten of which he has uninterruptedly published the *Lady's Book*.

Both of these venerable members of the press—and with the exception of William Cullen Bryant, we can recall

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none whose years of labor equal theirs—have long since earned the public gratitude for their good works. To Mrs. Hale was largely due the successful completion of Bunker Hill Monument. She is the inventor of Thanksgiving day, for she first suggested the idea of an American national thanksgiving in 1846, and her efforts toward the advancement and education of women have been untiring and fruitful with beneficial results. Both herself and her associate may look back with justifiable pride over the 571 numbers of the *Lady's Book*, which they have prepared, in the consciousness that their labors have tended always toward the promotion of education, culture and refined taste.

WATER SUPPLY FOR NEW YORK CITY.

The last plan submitted to the Special Committee on Water Supply for New York city is by a Brooklyn engineer, who claims a cheaper mode of getting water than by going fifty or sixty miles for it. His plan is the construction of a close canal or conduit, on a low level, of sufficient width and depth, commencing at Harlem river, running through Westchester, following the lowlands and keeping the depth below the well level. This conduit, he states, would always be full of the purest water, supplied from the great underground water basin of Westchester, and would in its course intercept all the springs and streams. Having studied the water supply of Brooklyn he was led to make a proposal to furnish that city with a future supply at a much cheaper rate than could be obtained by building reservoirs, and he thinks the same plan would be applicable to New York, although the soil is very different. The soil of Long Island is of such a nature that it readily absorbs all the rainfall. What streams there are come from springs fed from the higher grounds. The soil of Westchester is different from that of Long Island; it is harder and more compact, and much more of the rainfall runs off the surface; that which is absorbed remains longer in the soil. Hence a long drought would not affect the wells in Westchester as much as those on Long Island. The Brooklyn conduit, which carries the water to the pumping wells, was built as low as possible in order to collect the water from the different springs, yet built above the well level; and by extending it, sufficient elevation to the mile was given to impart the necessary current to send the water to the pumping wells, till now, in seventeen miles, it has risen above the springs and no more water can be obtained without building reservoirs, or adopting the plan he suggests. The conduit for New York was built high in order to get an elevation without pumping, and was carried back forty miles to the high ground of the Croton, passing many streams and getting no advantage from the many valleys in its course, or from the great water shed lying within thirty miles of New York—resources sufficient, if improved, to give an abundant supply for all time.

It is contemplated to build more reservoirs on these high elevations at a cost of $10,000,000, and to build a new conduit between New York and Croton Dam at a cost of $10,000,000 more. In regard to this, he says, to keep building expensive reservoirs on these high elevations is a waste of public money, and will naturally prove a failure as to a future supply, for, as the line is extended, it must keep rising, although already it is above the springs. What water may be obtained in this way is from storm flows, collected during the time of freshets, and retained in their shallow basins, stagnant pools, exposed to the rays of the sun and infected by vegetable decomposition, with no circulation whatever until it is let off into the conduit, thus distributing the seeds of malaria. The best place for reservoirs is where you can get the purest water, and that is at the foot of the hills. Here not only the surface flow is got, but as much more pure spring water, filtered through the upper lands. The expense of pumping will not compare with that of building costly reservoirs on such high elevations; but, even if it did, the sanitary advantages would more than compensate. As the land naturally rises from Harlem river, a conduit could be built on a slight elevation to the mile, of sufficient width and depth to bring to the city as much water as would be needed for all future time. The water in the canal would be spring water and a running stream. The pumping engines could be placed at the Harlem river, and pump directly into the pipes, under pressure, giving the water sufficient force to carry it into the top story of the houses on Murray Hill, leaving the old aqueduct, with its reservoirs, to supply the lower portion of the city.

In brief, the plan is to have one main conduit, commencing at a point west of King's Bridge or east of Central Bridge on the Westchester side of the Harlem river, extending up through Westchester, with lateral branches, running right or left as the nature of the ground may indicate; smaller ones to be built in each of the different valleys, and a cross tunnel made to intercept them all. By this means a large amount of water could be obtained, and the conduit could be extended according to the growth of the city. The main conduit at the commencement would not be less than twelve feet in diameter, or of sufficient capacity to deliver two hundred million gallons daily; it could be diminished as extended. The side walls of the conduit would be of heavy stone laid dry, backed up with small ones, the bottom paved with cobble stone, the top arched with brick laid in cement. The pumping wells and buildings could be erected on the New York side of the Harlem river: the river to be tunnelled with either an iron or a brick tunnel of the same dimensions as the conduit, the top to be twelve feet below low water mark. All the overflow would empty into Harlem river.

An approximate estimate of the cost of such works, with five compound steam pumping engines of the most approved kind, with their boilers, fixtures, and buildings to pump one hundred million gallons of water per day at $9,500,000, exclusive of the right of way, which would not cost much, as the conduit would be mostly underground. Much of the tunnelling could be done without disturbing the surface. The principal and only damage would be the surplus earth left in places. As the conduit would follow the low lands, their drainage would mitigate damages.

'THE GREEN CORN CASE.

The celebrated "Green Corn Case," which was argued last September in the Circuit Court at Baltimore, before Judges Bond and Giles, has recently been decided, and the bill for the injunction dismissed. This case was an application by John Winslow Jones for an injunction against Louis McMurray, of Baltimore, for an injunction to prevent him infringing the re-issued patent No. 7,061 (original patent No. 35,274), covering a process of canning green corn, and re-issue No. 7,067 (original patent No. 34,928), for the product of said patented process. The original patents were declared invalid by the Supreme Court of the United States. They were then surrendered and the re-issued patents obtained, which formed the basis of this suit. The complainant avers that the decision of the Supreme Court was given against him because of his "defective specifications," which have been cured by the re issues obtained since the decision referred to. The circuit judges, however, in the present case, have a different opinion of the Supreme Court decision than that entertained by the plaintiff, and state that, "while we are of opinion that the decision of that court is much broader than the complainant admits, and that it goes to the whole invention then and now claimed by Jones in the patents we are here considering, and that it determines that both the process and product now claimed by Jones was the invention of Appert, in France, and Durand, in England, more than sixty years ago, and held that Jones' patents were void for want of novelty, and not merely invalid for want of a proper specification and description of Jones' claims, nevertheless, since the Commissioner of Patents has issued the patents to Jones, we would give him the benefit of them could we discover in what respect they differed from the originals, which the Supreme Court has decided were void. There is no essential difference, however, between the process described in the first patent and the re-issue. The first recites that, after some difficulty found in preserving green corn without drying, the inventor removed the corn from the cob and boiled it, but that by this process the corn, being broken by removal from the cob, dissolved out the juices and made the corn insipid, and then he finally removed the corn from the cob, packed the kernels in cases, hermetically sealed them, and boiled them until the corn was cooked." The Supreme Court, in the case of Sewell *vs.* Jones, says this is not new. Complainant, in his re-issue, states he pursues another plan, whereby he separates and retains the nutritious and edible parts of the corn, boiling them in a liquid of their own juices. No one ever cut green corn from a cob who did not do exactly what this claim describes, and no one under the process described in the patent, which requires the corn to be removed from the cob, could so remove it without breaking the kernels, and when he cooked it in a can, as the patent required, he would find necessarily more or less of the juices with it. The process described in the re-issue is substantially that of the original patent. But if we admit there is something new and patentable in the re-issued patent, which was not in the original, the patent is void, because it is not for the same invention as the original. * * * * It cannot, therefore, be claimed that the re-issued patent contains anything which the original did not, and the original, says the Supreme Court, is void for want of novelty." The patents also described the use of a curved knife to remove the corn from the cob, but this does not appear to add any novelty or patentability to the alleged invention, for the knife differs nothing in principle and little in construction from some styles of spokeshaves or paring knives, and even if the validity of these patents could be admitted on reference to this point, the court could find no evidence that the defendant, McMurray, has infringed them by using the knife of complainant, but, on the contrary, the proof shows that he used a different knife entirely. For these and other objections to the complainant's case, the bill for the injunction was dismissed, with costs. Numerous other suits have been entered by Jones against other parties in New York, Boston, Portland, Chicago, and other parts of the country, which will probably be influenced to a considerable extent by this decision.

HOW TO MAKE HOMES HEALTHY.

Most cases of infectious diseases have, in addition to the common epidemic influence, a direct exciting cause. This will be found, when contagion is excluded, to be poisonous emanations of some kind in the house, or on the premises, or in the drinking water; in cities generally sewer gas. Dr. Chapman, of Brooklyn, to whom we refer in another article, after experiments, has settled on the following plan as a sure relief from sewer gas: The soil pipe running from the cellar passes through the house and opens into the kitchen flue at the top story. The pipe should be four inches in diameter. It will be freely ventilated by the draft of the flue. Into this soil pipe or ventilator, the waterclosets and basins on the different floors empty through traps. The water from the upper closet, running past the opening of the lower closet, would be apt to suck its trap dry, and to prevent this a separate ventilating pipe is run from the traps of the lower closets to a point in the ventilator above the upper closet. In this manner all foul gases at once pass upwards and empty at the top of the house. In several houses where malarial disease had been frequent, since the introduction of this plan the residents have been free from all disease due to blood poisoning.

BREAKAGE OF A STEAMBOAT BEAM.

The Harlem, a passenger steamboat plying between New York and Harlem, recently broke the working beam of her engine. The break took place between the eye of the main link and the main center of the beam. The beam is of the usual American type, having a cast iron skeleton frame bound round with a strap of wrought iron. The fracture of the lower part of this strap shows that a flaw has existed for some time but was not perceptible, being covered by a vertical strap. The fracture of the cast iron skeleton frame and the upper part of the wrought iron strap showed a good quality of iron, the former being of a gray color and close grain, and the latter of a fibrous nature. The rectangular cross section of the strap, where the flaw is, and where the break first commenced, is in size 5 by 3¼ inches. The length of the beam is 15 feet 6 inches by 8 feet wide.

The point of interest is the fracture of the wrought iron strap where the flaw is, and the iron shows crystallization. As the flaw was concealed from view it becomes a matter of speculation how long it has existed, and whether it resulted from inferior iron or from crystallization gradually taking place as the result of constant vibration. The excellent appearance of the iron in the upper part of the beam strap seems to indicate that the iron when first put round the skeleton was all of good quality, and that a change took place in the lower half or some portion of it.

The experience as to iron undergoing a gradual deterioration under certain circumstances is too universal to be discredited. The multitude of theories put forth to account for it bear witness to the fact, although an explanation of the phenomenon is still required. Mr. Roebling, the late distinguished engineer, assumed that the drawn out fiber of wrought iron is "composed of an aggregate of pure iron threads and leaves, enveloped in cinder. Wrought iron thus becomes brittle under long-continued vibration under tension, because the iron threads and laminæ become loosened in their cinder envelopes."

The Northern Lights.

The Finland observations of northern lights in the years 1846–1855, numbering 1,100, have recently been compared by M. Fritz, in the *Wochenschrift für Astronomie*, with auroral phenomena of the same period in all other regions. This comparison leads to results which are interesting as bearing on the theory of the phenomenon. The table shows that of 2,035 days of the months August to April, on which northern lights were seen, 1,107 days were days of northern light for Finland. On 794 days northern lights were visible simultaneously in America, and mostly also in Europe; on 101 days only in Europe, and on 212 days only in Finland. They were on 958 days visible in Europe and America, and not visible in Finland. The conclusion is thus reached that a large portion of the polar lights have no very great extension, or that the causes producing them must often be of a very local nature, while in another portion of the phenomena the regions of simultaneous appearance are very considerable. The number of those phenomena which are limited to Finland is very small. With the increase of frequency of the phenomena, at the time of maximum, their number observed in Finland and America on the same day increases; while those observed in Finland and only in Europe, or those in Finland only, decrease. These relations correspond to the known law, that with the frequency the intensity and extent of the polar lights also increase.

Yellow Fever Infectious.

Many medical men hold that yellow fever is not infectious. Mr. Jasper Cargill, of Jamaica, W. I., relates, in the *Lancet*, several instances which came under his notice in which there would be no doubt whatever that the disease came from infection. The sufferers were colored people fully acclimatized to the Jamaica climate, so that there was no pobability of the fever having bred in themselves; besides the place of infection was very clearly ascertained.

Lead Explosions.

Many mechanics have had their patience sorely tried when pouring lead around a damp or wet joint, to find it explode, blow out, or scatter from the effects of steam generated by the heat of the lead. The whole trouble may be stopped by putting a piece of resin, the size of the end of a man's thumb into the ladle and allowing it to melt before pouring.

THE famine in India has quadrupled the death rate in the city of Madras. The death rate in July was 1,150 weekly. During the week ending August 17th, 1,051,000 persons were receiving relief in the Madras presidency. In thirteen affected districts the annual death rate in the week was equal to 483 per 1,000, signifying that if this rate continued for a year scarcely more than half the population would survive.

TO COAT iron with emery, give the metal a good coat of oil and white lead; when this gets dry and hard, apply a mixture of glue and emery.

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[*Continued from first page.*]

ser, and its refrigerator holds about 1,700 lbs. of oxide. The non-congealable liquid is a saturated solution of chloride of magnesium, which has given better results than the glycerin and water mixture. The tension of the oxide vapor varies from 14·7 to 13 lbs. about, and on the return stroke the gas is compressed to ¼ or ⅛ its original volume, having its temperature raised to 200° Fah. The cold water current reduces this temperature to about 61° at the outlet, and then, under the pressure of from 3 to 3½ atmospheres, the gas returns to liquid state. When the ice in the freezing boxes is formed, the workmen, by means of the crane shown in Fig. 1, which moves around an axis in the center of the large tank, lifts out the boxes one by one, and dips them in hot water, so that the block of ice within may become detached. The block is then removed and the box, replenished with fresh water, is replaced. The pressure in the condenser, we are informed, does not exceed 35 to 37 lbs. per square inch above atmospheric pressure—the average absolute steam pressure in the engine cylinder is 30 lbs. maximum. No difficulty is experienced in keeping tight joints, and the loss of oxide per week does not exceed ½ lb. The magnesium chloride or glycerin solution rarely needs renewal and is always cheap.

It is claimed that 1 lb. of acid by volatilization produces nearly 1 lb. of ice. From the apparatus illustrated in Fig. 1 the following data have been obtained: Average horse power of engine, 73 to 75, of which 23 horse power is used for the condensing pump, circulating pump, boiler feed pump, air pump, and acid pump. The quantity of ice produced was 18 to 20 tons in twenty-four hours; coal burned, 2⅛ tons per day; the average production of ice is claimed to be from 9 to 10 tons per ton of coal. The cakes of ice measure 12 inches by 6 inches by 36 inches, and weigh 83 lbs. each.

The following data show the inflammability and explosibility of various substances used in ice-making.

Names of substances used in ice-making.	Boiling point at atmospheric pressure in degrees Fahrenheit.	Pressure of vapor in lbs. per square inch at 65° Fahrenheit.	Specific gravity of liquid at 40° Fah. water = 1.	Specific gravity of vapor at 40° Fah. Air = 1.	Latent heat of vapor by equal weight.	Relative latent heat of vapor by equal volume.
Chymogene, gasolene, and other derivatives of petroleum*	30 to 50	12 to 17	0·6	3·9	170	663
Methylic ether*	—6	90		1·617	240	384
Ammonia†	—30	120	0·76	0·59	900	511
Anhydrous sulphurous oxide‡	14	52	1·49	2·25	170	392

*Inflammable and explosible. †Explosible. ‡Extinguishes combustion, not explosible.

The manufacturers furnish us the following estimate of maximum cost to produce 250 tons per day of 24 hours. Employees, $51.00; oxide, at 4 lbs. per week, 37 cents; oil, $2; coal, 22⅛ tons at $4.25 per ton, $105.63. Equivalent to 63⅝ cents per ton actual cost of manufacture.

Estimating capital at $250,000, and adding taxes, office expenses, wear and tear, insurance, etc., the total cost comes to $1.05 per ton of ice.

Attention is called to the advantage of the low boiling point of sulphurous oxide, which is 14 Fah. as compared with chymogene, which is 30° to 50°. Also the advantage of the pressure of vapor of the oxide at 65° Fah., namely, 52 lbs., instead of the very low pressure of chymogene, 12 to 17 lbs., which results constantly in the pumps using the latter working almost in a vacuum. The disadvantage on the other hand of the high pressure of ammonia is obvious.

For further information address the Pictet Artificial Ice Company, room 51 Coal and Iron Exchange Building, corner Courtlandt and Church streets, New York city.

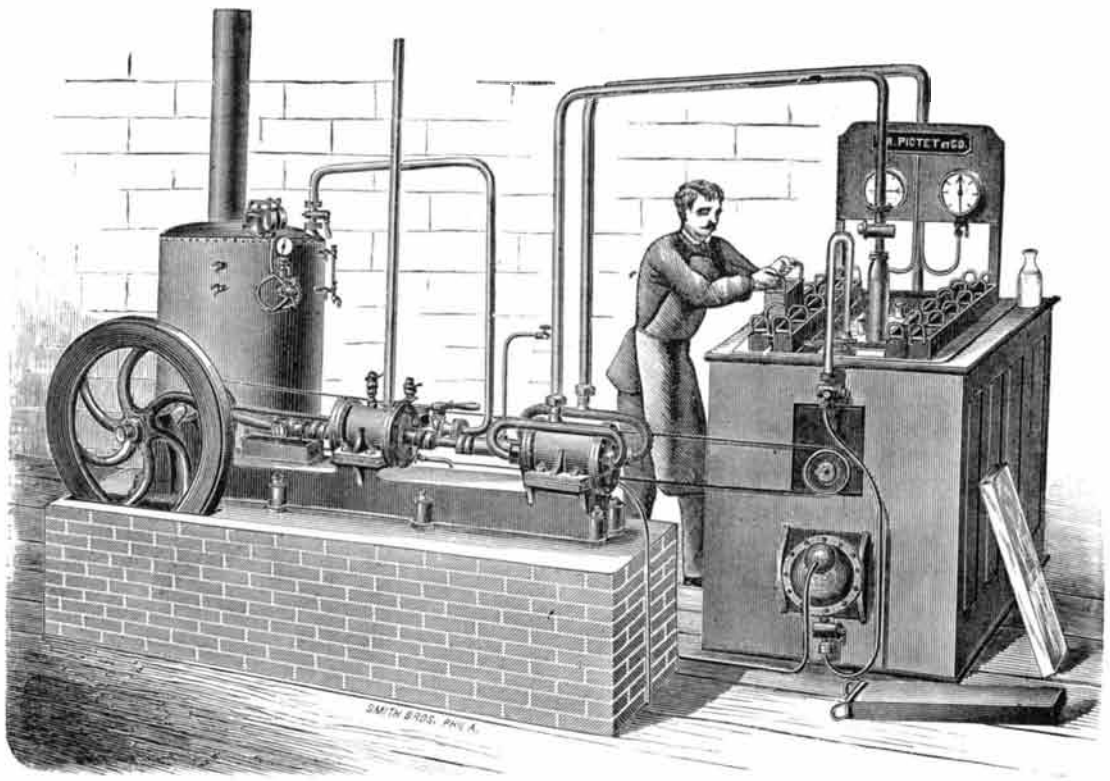


Fig. 3.—THE PICTET ARTIFICIAL ICE MACHINE.

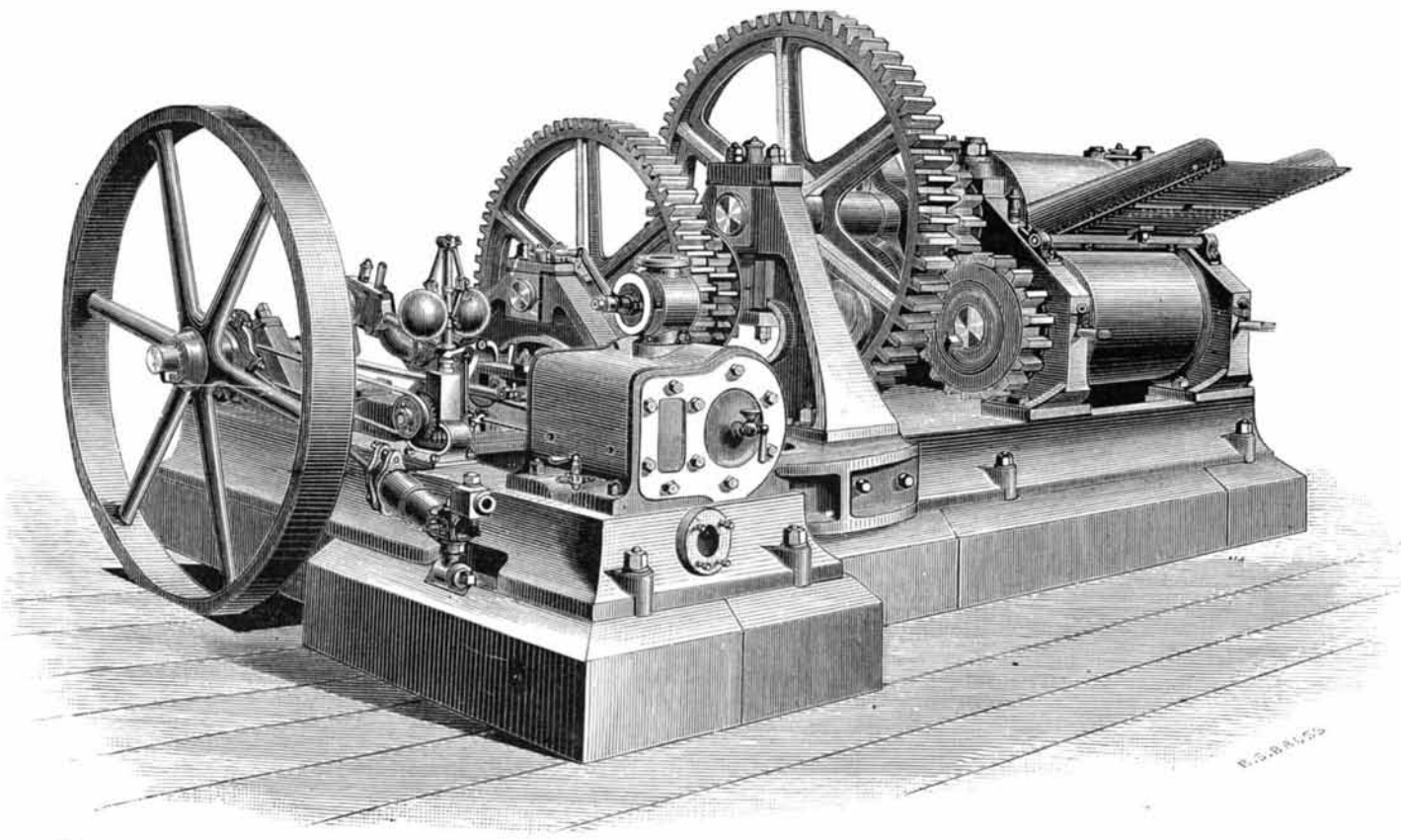
Keeping Fruit Fresh.

The following is said to be a good process for keeping fresh fruit through the winter: Mix rosin 2 lbs., tallow 2 ozs., beeswax 2 ozs., slowly over a fire in an iron pot, but do not boil. Rub each fruit separately with pulverized chalk and dip it in the mixture. Hold it up for a moment to permit the coating to set, and pack away carefully in a cool place.

COMBINED ENGINE AND SUGAR CANE GRINDING MILL.

We select from *Iron* the accompanying cut of a combined engine and sugar cane grinding mill, manufactured by Messrs. Robey & Co., of Lincoln, England.

The mill is especially designed for small plantations. The rollers are three in number and are placed horizontally, one over the other two. These rollers are 20 inches in diameter and 30 inches long, and are keyed on to their respective shafts. On one end of these shafts are pinions, which are driven by a train of strong gearing actuated by the horizontal engine, which is of 8 horse power nominal, but capable of working more than that power. The whole is fixed on strong foundation plates, by which arrangement the fitting up is much facilitated. For the sake of greater ease in transit, these plates are made in two parts. The cane is conveyed to the rolls by a carrier worked from the mill, consisting of chains on a series of wooden rollers.



COMBINED ENGINE AND SUGAR CANE GRINDING MILL.

Vitality of Ants.

Several interesting observations have been made by the Rev. H. C. McCook on the endurance of extremes of heat and cold by ants. This year a formicary of *F. pennsylvanica* was cut from an oak bough and exposed out of doors to the rigor of a mountain winter, and survived. A number were dropped separately upon ice, and were found alive after forty-eight hours, each in a little depression. *F. rufa* was found active in its formicary at 34° F., sluggish at 30°. The extreme of heat seemed also to be endured by *F. pennsylvanica;* they did not suffer at all from the heat of stones walling in a camp fire, having been driven into this position out of a burning stump. A community of agricultural ants (*M. molefaciens*) lived in a mound upon which some smiths in Texas made their fires for heating wagon tires. Numbers of ants were seen at work by Dr. Lincecum, cleaning out the entrance to their city, before the entire extinction of the fire just used for heating tires. They had learnt all about the fire, and knew how to work in and around the dying embers without injury. A quantity of mason ants (variety of *F. rufa*) observed by Mr. McCook were accidentally flooded under five inches of water, and they appeared to be quite dead, and floated about in this condition for many hours. But subsequently most of them recovered full activity. In Texas Mr. Lincecum found that the agricultural ants are seen in great numbers in wells, forming a sort of floating mass as large as an orange, clinging together. In this condition they get drawn up in the bucket, and though they may have been in the water a day or two, they are all found alive. Yet individuals cannot survive under water more than six minutes; and life in these balls can only be preserved by the mass revolving, either by the continued struggles of the individual insects, or by an instinctive and orderly movement of the outer tier of ants.—*Proc. Acad. Nat. Sci., Philadelphia.*

Boring Power of Magilus.

We have received from Mr. Charlesworth a preliminary note giving briefly a result of his study of the genus magilus, the remarkable testaceous gasteropod that is found immersed in the large hemispherical corals of the genus meandrina. The current belief, as set forth by Sowerby, Owen, Woodward, and other authorities in molluscan biology who have treated of this coral-inhabiting mollusc, is that magilus in its young state effects a lodgment in a crevice of a meandrina, and that as the coral enlarges the magilus extends the margins of the mouth of its shell in the form of a cylindrical corrugated tube, the growth of this tube and of the coral proceeding together *pari passu*, and consequently that there is no penetration of the coral by the magilus at all. Mr. Charlesworth, however, finds that magilus not only drives through solid masses of coral in any direction with apparently the same facility that the bivalve teredo tunnels masses of wood, but he finds that it even surpasses teredo in its power of suddenly reflecting its shell and returning to the point from which it commenced its advance; and this bending back of the shell upon itself is not accomplished in such natural cavities as frequently prevail in large corals, but in the solid coral.—*Nature.*

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The Electric Light.

A special division of the Paris International Exhibition will be devoted to electricity, so that all the systems of electric lighting may be tested comparatively. The electric light continues to create the greatest interest in Paris. The experiments which we mentioned some time ago have been conducted during forty consecutive days at the Lyons railway station. A force of about 40 horse power is sufficient to keep going twenty-eight electric lamps, each of which gives a light equal to eighty gas lamps, and works with regularity for ten and a half hours. The effect is splendid, the whole of the station, except the waiting room, being lighted *à giorno*. The question of economy, however, is not yet settled. It is not known whether the company will agree to pay a somewhat higher price in order to multiply the power of its illumination. These experiments have been tried on Lontain's system, a modification of Wilde's and Siemens' principle. M. Lontain has contrived to send the current generated by an ordinary Wilde's machine into an electro-magnetic engine called a distributer. The central part being strongly magnetized by the current from a Wilde's machine, a number of electro-magnets are influenced by its rapid rotation, and in each of these an induction current is generated. These induction currents are powerful enough to feed three electric lamps; and as there are two series of twelve magnets, a single machine could, theoretically, feed seventy-two lamps. Actually, however, it feeds only twenty-eight. Lontain uses a new regulator, which works very well by the dilatation of a small silver wire. By its dilatation this part of the apparatus works a lever system, and brings the carbon electrodes into contact. The French Northern Railway has purchased a number of Gramme magneto-electric machines. They intend to use them at their goods terminus and stores.—*Nature.*

A New Indicator for Alkalimetry.

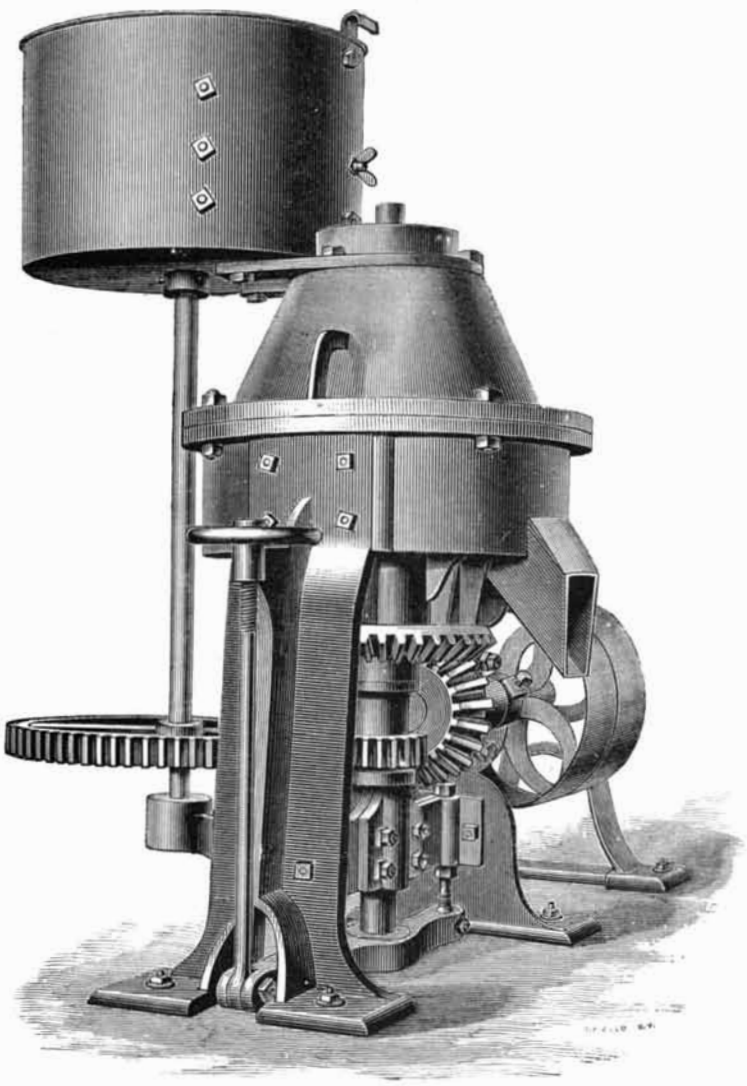
E. Luck proposes to employ, as indicator for volumetric estimation of acids and alkalies, phenolphtalein, a new dye stuff, prepared by Baeyer by heating together phenol (carbolic acid), anhydrous phtalic acid and sulphuric acid. In dilute aqueous or acidified liquids this dyestuff is colorless, but the addition of the slightest excess of alkali produces an intense purple red color, which is destroyed again by a trace of acid. For use, 1 part of phenolphtalein is dissolved in 30 parts alcohol, and 1 or two drops of this solution added to every 100 c. c. of liquid to be titered. If the liquid is acid it becomes opalescent at first, but clears on stirring. One drop of dilute soda lye or acid is more than sufficient to cause the change of color.

THE ROSS BURR STONE GRINDING MILL.

The annexed illustrations represent the Ross burr stone grinding mill, which is adapted for the grinding of flour, corn meal, paints, spices, and other dry materials, besides printers' ink, chocolate, paste blacking, and other substances of similar consistence. It runs at high speed, is claimed to grind fine and fast, and to consume but little power. The chief feature in the construction is that the grinding is done at the circumference and near to the center of motion instead of by the flat face of the stone.

Fig. 1 represents the mill with mixer attached, by which the materials to be ground are thoroughly mingled before entering the mill. In grinding paint the addition of the mixer is considered advantageous, the paint is thus kept cool, owing to the top of the mill being open so that the heat escapes instead of being absorbed by the paint. From the sectional view, Fig. 2, the internal arrangement of the machine will be clearly understood. The contents of the hopper are drawn down between the stones by the screw, A. The moving stone, B, is in the shape of a conical frustrum, and is attached to a vertical shaft which is rotated by the gearing shown. The outer stone is inclosed in the casing and is of a shape to receive the stone, B, in internal contact, adjustments of the latter being effected by the nut, C. As D is a small pipe to conduct the lubricating oil to the shaft bearing. The entire construction is simple and strong. The manufacturers claim that the mill now grinds nine tenths of all the printers' ink made in the country, and submit to us records of numerous premiums received (notably two gold, seven silver, and two bronze metals from the American Institute) besides many excellent testimonials from parties experienced in its use.

For further information address the manufacturer, Mr. Charles Ross, Jr., 81 and 83 First street, Williamsburgh, N. Y.



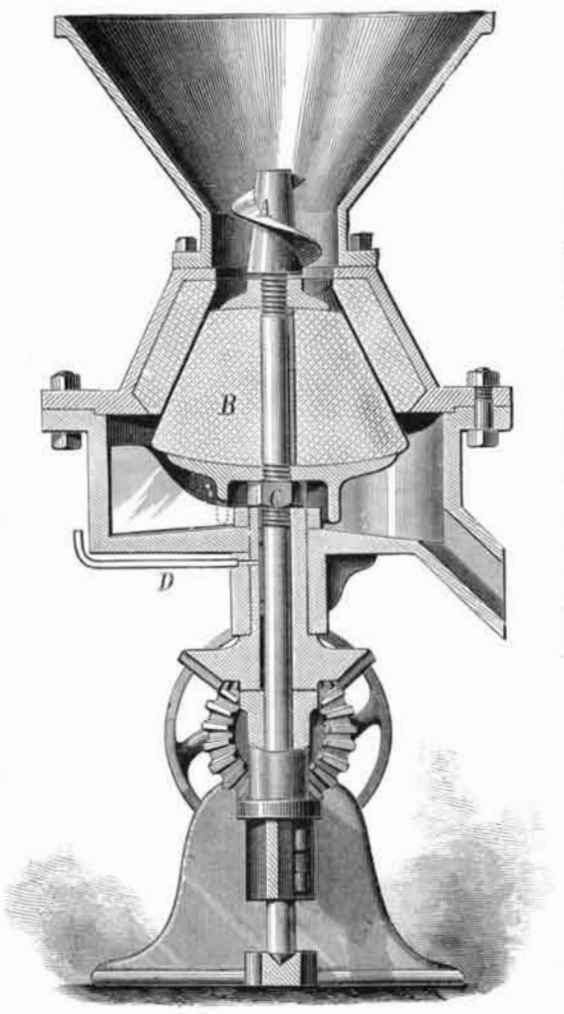
THE BURR STONE GRINDING MILL.—Fig. 1.

Restoring the Color of Lace.

LACE may be restored to its original whiteness by first ironing it slightly, then folding it and sewing it into a clean linen bag, which is placed for twenty-four hours in pure olive oil. Afterwards the bag is to be boiled in a solution of soap and water for fifteen minutes, then well rinsed in lukewarm water, and finally dipped into water containing a slight proportion of starch. The lace is then to be taken from the bag and stretched on pins to dry.

Electricity for Sleeplessness.

That galvanization of the head has an hypnotic effect has long been known: hitherto, however, it has not been used to counteract sleeplessness. Vigoureux asserts (*Allg. Wiener Med. Ztg.*) that he has daily obtained the finest results in this direction, and has failed only in exceptional cases, as, for instance, when sleep has been disturbed or prevented by severe dyspnœa. His method is to place the broad, flat electrodes (carbon covered with chamois leather) on both temples, and allow the current of from three, at the most five, Trouvé's elements to pass for a half or a whole minute. When the application is made in the morning, the patient experiences a more or less pronounced inclination to sleep. Occasionally the effect of the galvanization is prolonged after the first night, for a night or two.



THE BURR STONE GRINDING MILL.—Fig. 2.

Soup Kitchens.

Aside from the question of establishing soup houses for the poor in large cities, the question of the minimum amount of food at the lowest cost which shall be sufficient not to maintain life merely, but health and strength, is a subject of frequent discussion at the present day, and in this connection some extracts from Professor Voigt's report to the Munich magistrates may prove of value. Professor Voigt's first problem was to determine the quantity of the chief constituents of food which a soup kitchen ought to give to each person for a noonday meal. He decided that a grown up laboring man required 59 grammes (910 grains) of albumen, 34 grammes (524 grains) fat, and 160 grammes (2,569 grains) or carbohydrates.

From the reports of several of these soup houses in various parts of Germany, and the bills of fare in them, he calculated the amount of each substance given by them, and found to his dismay that none reached the required standard, and some fell far below. We give his table of results:

	Albumen.	Fat.	Carbohydrate.
Required amount.....	59	34	160
Munich soup house.....	14	3	32
Leipsic Volk's kitchen.....	24	8	71
Dresden " "	37	10	100
Berlin " "	35	19	178
Egestorff's " in Hanover	35	8	110
Eating Institute of Hamburg	41	5	133
Hamburg Volk's kitchen....	50	11	187
Cologne " "	49	—	188
Carlsruhe eating house.....	58	16	180

Here is evidently a shrewd exception, says Voigt. Even if people are contented with the volume of the meal and feel sated, still they have not necessarily taken sufficient nourishment for noon. Only a small portion of the volks kitchens furnish a sufficient quantity for an old and feeble beneficiary or pauper, namely, 40 grms. albumen, 30 grms. fat, and 85 of carbohydrates, and none sufficient for a working man. In most cases, to be sure, the carbohydrates are in sufficient quantity, but not the albumen. In most cases throughout the list the fat is lacking to a surprising extent, and it appears as if they were ignorant of its importance: and yet a good suet soup is craved by the common people.

In these institutions it is evident that more attention has been paid to cheapness than to the proper composition of the food; it is just impossible for most of them to afford the necessary quantity at such low prices. It was only in Carlsruhe that the dinner came tolerably near the scientific requirements. Such food was prepared there for 30 pfennige (7½ cents), and Professor Voigt's model recipe could be carried out with twenty changes, in Munich, for that price. Voigt also calls attention to the actual nutritive value of the so-called relishes or seasoning, which impart an agreeable flavor to the food, and also to the animal gelatin to be extracted from bones and sinews, which protects the albumen in the body from decomposition. The excessive use of bread and potatoes should be combated by the broad influence of these people's kitchens.

In an able-bodied working man, the waste which should be supplied amounts to 118 grammes albumen, and 265 grammes carbon, partially in fat and partially in the carbohydrates. Of the carbon not more than 209 grammes should be carbohydrates, or bread, potatoes, and farinaceous food generally, and 56 grammes as fat.

The report concludes with Voigt's model recipes for the requisite amount of nutriment, but as these apply only to Munich, we will not reproduce them here.

The difficulty in prescribing any given regime, whether for health alone or for economy combined with health, is the great diversity of tastes which exists among every class and makes true the saying that "what is one man's food is another man's poison." It is seldom the case that the system is benefited by an article of food not demanded by the appetite, much less by food that provokes disgust or nausea, however perfect it may be from a scientific point of view.

Laundries Spreading Disease.

The London *Lancet* says that incidents confirming the belief that diseases are spread by laundries are constantly reported as occurring in England and on the continent. Clothing worn by diseased persons or persons who have died of infectious disease are washed together with other clothes. The germs thus sown soon propagate, until an epidemic is created, as has been several times the case. Too much care cannot be exercised in this respect. The clothing should either be burned or thoroughly disinfected and washed apart.

Cleaning Engravings.

Put the engraving on a smooth board, cover it thinly with common salt finely powdered; squeeze lemon juice upon the salt so as to dissolve a considerable portion of it; elevate one end of the board, so that it may form an angle of about 45 or 50 degrees with the horizon. Pour on the engraving boiling water from a tea-kettle until the salt and lemon juice be all washed off; the engraving will then be perfectly clean and free from stains. It must be dried on the board, or on some smooth surface, gradually. If dried by the fire or sun, it will be tinged with a yellow color.

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Communications.

Our Washington Correspondence.

To the Editor of the Scientific American:

Notwithstanding the delay of business and various embarrassments resulting from the late fire, the receipts of the Patent Office for the month of October from all sources amounted to the large sum of $55,134.03, as against $53,147.82 received during the corresponding month of last year, an increase of $1,986.20. With two exceptions only, the receipts for the past month are larger than those for the same month of any year since the foundation of the Office. The grants of patents during the first ten months of the year do not, however, correspond with this, as the issues of all kinds fall over 1,500 short of those of the corresponding months of last year. The following shows the number granted during the year up to and including the last issue of October: Patents, 10,924; reissues, 481; designs, 604; trade marks, 1,042; labels, 291; total, 13,342, as against a total of 14,886 issued during the same period of last year.

PATENT MATTERS IN CONGRESS.

Some attempts are being made to shorten the life of patents, by the introduction of bills in Congress to accomplish this purpose. One was introduced by Mr. Pridmore, which enacts that "Every patent shall contain a short title or description of the invention or discovery, correctly indicating its nature and design, and a grant to the patentee, his heirs or assigns, for a term of seventeen years, unless the invention be upon an agricultural, horticultural, or mechanical implement or tool, in which case it shall only be for a term of eight years, of the exclusive right to make, use, and vend the invention or discovery throughout the United States, and the Territories thereof, referring to the specifications for the particulars thereof. A copy of the specifications and drawings shall be annexed to the patent, and be a part thereof. And no patent shall be reissued upon any article or improvement thereof to which the limit of eight years applies."

Another bill, introduced by Mr. Oliver, provides that hereafter patents shall be granted for ten years only, but may be extended for a further term of ten years under the provisions of the law regarding extension of patents formerly in force in extension cases. The total duration of any patent hereafter granted, however, must not exceed fifteen years.

THE COURT OF CLAIMS.

Senator Mitchell has introduced a bill extending the jurisdiction of the Court of Claims of the United States, which provides that, if the Secretary of War, Treasury, or Interior Departments, or the Postmaster General, or any other official of the United States, acting under authority from the head of any executive department or bureau, has used, or hereafter uses, in the public service, any invention upon which letters patent of the United States have been issued, by means of which the public service has been or is improved or benefited, the Court of Claims shall be vested with full and exclusive jurisdiction in and over all such cases. It further provides that either the complainant or defendant may appeal to the Supreme Court of the United States within ninety days after judgment or final decree shall have been made by said Court of Claims; such cases so appealed are to be preferred causes in the Supreme Court.

THE FRENCH EXPOSITION.

The House Committee on Foreign Affairs are holding daily sessions on the matter of the bill for providing for American representation at the Paris Exposition. The Secretary of State has sent a communication to the Committee, recommending an appropriation of $225,000, and suggesting also that the bill should contain a provision for transporting intended exhibits from interior cities to the seabord. Representative Hewitt has appeared before the Committee by invitation, and made some additional statements in advocacy of the legislation proposed by his bill on the subject.

Messrs. Salmon and De Stuckle, of New York, who claimed to represent many intended exhibitors, have also appeared and laid before the Committee the plans and regulations of the Exposition, and explained the location and dimensions of the American department. They also suggested that the number of skilled commissioners should be enlarged from fifteen to eighteen, allowing one artizan and one scientific man to each of the nine groups; and that the exhibitors should be given a voice in the selections of American members of the international jury.

PRESERVATION OF FORESTS.

Every now and then Congress takes a step in the direction looking to the preservation of the forests of the country, which are disappearing altogether too fast, but for some reason or other the bill hardly ever gets any further than the committee rooms, or if it should succeed in passing one house, it always fails to reach the other in time for action. Now, however, simultaneous action in both houses is proposed by the Forest Association of Chicago, which body presented memorials to both the House and Senate, setting forth the wisdom in appointing a commission to proceed to Europe to examine into the forests of European countries, with a view to make such adaptations of the Old World practices in regard to the preservation of forests and tree cultivation as may prove advantageous here. Some legislation, it is agreed by every one, is absolutely necessary to prevent the ruthless destruction of trees, and the Committee on Agriculture, to which the subject has been referred, can confer great advantage on the country by acting promptly, by reporting a bill of some kind, intended to further the objects of the association in the manner indicated in the memorials, or by some more direct legislation.

JUDICIAL CONSTRUCTION OF PATENTS.

An opinion of the Supreme Court of the United States has recently been made public, which appears to be important in view of the decisions of some of the circuit court judges, who seem to think that the proper way to construe a patent is by what is shown or hinted at in the specification, rather than what is covered by the claim. The case referred to was an appeal from the decision of Judge McKernan of the Eastern District of Pennsylvania, made in a suit brought by the Keystone Bridge Company *vs.* Phœnix Iron Company, for an alleged infringement of the first claim of Surville & Piper's patent of January 14, 1862, and the third claim of a patent issued to the same parties October 31, 1865. The point in controversy was the construction of the claims, which on their face appeared to cover only chord bars made, by upsetting the ends, when the bodies of said bars were *wide and thin*. The defendants' chord bars were of cylindrical form, so far as related to the bodies, but their ends were substantially like the plaintiffs', and the latter took the ground that they were not limited to the wide and thin construction, but to any form of chord bars in which the ends were upset like theirs. Judge McKernan, however, construed their patent in the exact terms of their claim, and as the defendants' did not make "wide and thin" bars, he held that they did not infringe; but waiving this ground, he further held that the claim of the patent being for "the use" in truss bridges, of chord bars constructed in the manner described, the method of making the same being disclaimed, and it appearing that the defendants had only *made* and *sold* chord bars, that they only did what they had a legal right to do, and did not thereby assume any responsibility for the wrongful acts of others. From this decision the plaintiffs' appealed to the Supreme Court, who affirmed the decree, but with reference mainly to the point as to whether the plaintiffs' should be held to the strict terms of their claims or not. Justice Bradley, who delivered the opinion of the Court affirming the decree, said that "When a claim is so explicit, the court cannot alter or enlarge it. If the patentees have not claimed the whole of their invention, they should have sought to correct their error by a reissue. They cannot expect the court to wade through the history of the art and spell out what they might have claimed, but have not. Since the act of 1836, the patent laws require that an applicant for a patent shall not only, by a specification in writing, fully explain his invention, but that he shall particularly specify and point out the part, improvement, or combination which he claims as his own invention or discovery. This provision was inserted in the law for the purpose of relieving the courts from the duty of ascertaining the exact invention of the patentee. * * * * This duty is now cast upon the Patent Office. There his claim is, or supposed to be, examined, scrutinized, limited, and made to conform to what he is entitled to. If the Office refused to allow him all he asks, he has an appeal. But the courts have no right to enlarge a patent beyond the scope of the claim, as allowed by the Patent Office, or the appellate tribunal, to which contested cases are referred. When the terms of a claim in a patent are clear and distinct (as they always should be) the patentee is always bound by it. He can claim nothing beyond it." The construction thus put upon the patent obviated the necessity of the court expressing an opinion on the other point made by the court below, namely, that the patents only covered the *use* of the chords in question in truss bridges, and not the *making* of such chords, which is all that the defendants are known to have done. The court therefore affirmed the decree of the court below, with costs.

The Supreme Court has also affirmed the decree of the Circuit Court for the District of New Jersey, in the case of Roemer *vs.* Simon *et al.* This was a suit for an alleged infringement of a patent to Roemer for an improvement in travelling bags, consisting in the application of two staples, or clamps, one at or near each end, to the frame of the bag, so that when packed the ends will remain closed. The defense was that the alleged invention was not original with the patentee, having been previously known to the public through a publication in London, from which it was alleged plaintiff had taken it and unjustly patented it in this country. The court below sustained the defense and dismissed the bill. It was contended in the appeal that the evidence should have been held sufficient to sustain the patent; that the patent itself is *prima facie* evidence that the invention was original with the patentee, which, supported as it was by a former adjudication, much stronger evidence than was adduced should have been required to overthrow the presumption in favor of its validity. Justice Clifford delivered the opinion of the court affirming the decree of the Circuit Court, with costs.

CROPS ABROAD.

The Commissioner of Agriculture has returns which indicate that, owing to the poor crops in England, that country will have to buy 104,000,000 bushels of wheat this year. The English crop was unusually poor this year, but on the continent of Europe there has been a fair general crop. In Eastern Europe the supply will not greatly exceed the demand, and it is certain the war will limit the exportation from Russia and Turkey. Egypt and India will have a larger surplus than usual, and will probably increase their shipments to Europe. Our export amounts now to 55,000,000 bushels, but the Commissioner thinks that this year we may be able to supply the entire British deficiency.

ENGLISH MANUFACTURES.

The State Department is constantly receiving reports from our Consuls, respecting the manufactures, commerce, etc., of the people where they are located. The Consul at Leeds, England, reports that our high tariff and home manufacturing have almost closed our markets against woolens and linens, which are their principal wares, the only demand being for a small quantity of the very highest class of woolens to meet the demand of those people who will have foreign goods no matter what price they have to pay for them. The decline of their exports, and the means to be taken to regain their former supremacy in this regard, are now the leading topics among the thinking people. Our Consul thinks that no effectual remedy can be applied, but that British commercial interests must decline, and that American interests will be affected in the inverse ratio. This is mainly owing to the perfection of our machinery, the style and finish of our goods, the results of the inventive genius of our countrymen, together with the acknowledged fact that our artizans will do a much larger amount of work in a given time than the English, which working together have not only shut out British manufacturers from our markets, but have enabled us to become a formidable competitor with England for the trade of other countries. A somewhat similar report comes from our Consulate at Lyons, France, which notes a decrease in the exports to the United States for the year ending September 30, 1877, as compared with the preceding year, of $1,522,835, which is a decrease of 15 per cent. The decrease in silk goods alone was more than 20 per cent of the whole export of these manufacturers. An increase in the export of raw silk to the United States of over half a million dollars (more than the entire export of the previous year) is noted as showing the large increase of our own manufactures. From our Minister to Holland we have a report containing some refreshing items in these days of bank and insurance failures, from which it appears that there has not been a bank failure in that country for forty years; that the paper money of the banks is equal to gold, and that, notwithstanding the rate of insurance does not average more than one half of one per cent, there is no such thing as a failure of a fire insurance company on record. First class railroad travel costs only a cent a mile, and yet the roads pay good dividends, as pilfering officials are scarcely ever heard of; and when they do shock the nation by turning up, they are severely punished and for ever disgraced. Dishonesty of any kind or failure in business means public dishonor, and utterly debars from any future public consideration. Four millions of people live within an area of 20,000 square miles, and all appear to be happy, prosperous, and contented; the secret of which appears to lie in the fact that all live within their income, and that industry and honesty are principles so firmly established that their violation is looked upon as an outrage on the national characteristics. From the Bahamas the consular report seems to show that our high tariff on salt and pineapples has a depressing effect on our trade with that region, as these articles have been hitherto the main export to the United States. The Consul thinks that if our high duties on these productions were abolished, an immense impetus would be given to the trade and industries of these islands, which would result in a large increase in our exports. Although it is not probable that under our present tariff any very great enlargement of the trade will be effected, yet even at present American manufactures are surely and steadily taking the ground of the British, and the islands rely upon us almost entirely for breadstuffs, salt provisions, tobacco, sugar, ropes, paints, oils, liquors, boots and shoes, and, latterly, American cottons are being exported. From our Consul at San Domingo we have a detailed account of the alleged discovery of the bones of Columbus in the Cathedral there, notwithstanding the fact that the bones of the great discoverer were believed to have been transferred to the Cathedral of Havana about 90 years ago, where they were supposed to have reposed ever since. If these are the true bones, the church authorities were guilty of fraud in palming off the bones of somebody else on the Spaniards for those of Columbus, and if not, they are trying to perpetrate one now. From Capetown, South Africa, it is reported that an International Exhibition is to be opened at that place next April, under the patronage of Governor Sir H. Bartle Frere, with an agricultural department organized on a grand scale. Diplomas of honor, with gold, silver, and bronze medals, will be awarded, and every facility will be given for the sale of articles exhibited, as well as for taking orders in the building. The exhibition will be divided into classes, which include foods, drinks, chemicals, perfumery, furniture, fabrics, sewing machines, domestic appliances, watches, jewelry, hardware, edge tools, cutlery, metals, agricultural implements, machinery, etc. Further information may be obtained by communicating with Edmund Johnson, delegate commissioner, at No. 3 Castle St., Holborn, London.

The Lighthouse Board gives notice that an automatic signal buoy has been placed off Cape Hatteras in 12 fathoms of water, Cape Hatteras bearing northwest by north, about 12 miles distant. The buoy is painted black and white in perpendicular stripes, and occupies the position of the buoy which disappeared from its moorings early in October.

Washington, D. C. OCCASIONAL.

To MAKE hard tallow candles, use a mixture of mutton tallow 10 ozs., camphor ¼ oz., beeswax 4 ozs., and alum 2 ozs.

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New Inventions.

Setting up Music by Machinery is the subject of Mr. Hannibal Goodwin's (of Newark, N. J.) late invention. The idea is to produce plates by which in connection with any of the well known photolithographic processes music can be rapidly and economically printed. The music is set up on a grooved board and then photographed. The photograph is used for the production of photolithographic plates.

A new adjustable Rowlock has been patented by Mr. William B. Padgett of Batesville, Ark. The general arrangement is such that the oar works in a universal joint. The advantages are that the oar may be moved with less friction, lengthened or shortened as desired, easily attached and detached from the boat, and that it will not when left to itself catch on any obstruction.

An improved device for Measuring Beer and other liquors that foam when drawn has been patented by G. J. Cave and G. E. Nicholson of Elizabeth, N. J. In the bottom of an ordinary measure is a small box, in the top of which is a screw cap perforated with a small hole to allow the liquid to pass to the box. A short elbow is secured to the side of the measures and opens through a hole in the lower part into the box. A glass tube rests in the elbow, upon the upper end of which is placed a ring of rubber which is pressed down upon the glass tube by a plug. This plug has a hole formed through it, to allow the air contained in the tube to escape. The tube is surrounded by a case arranged with cross bars which serve as indices of the liquid within. If the tube is broken it can readily be replaced.

A useful as well as ornamental Cane patented by James Pool of Friendsville, Ill., is a curious combination of instruments. In the handle is a microscope, in the top a compass, in the center a spy glass, and on the outside a thermometer. All of these parts are readily detachable and fit snugly together.

A new Apparatus to Cleanse Feathers by steam has been patented by J. J. Van Alstine of Bristol, Wis. The feathers are placed in a double walled bottom chamber, having a series of perforations and containing perforated steam pipes and is provided with a double walled upper part. A reel agitates the feathers with a series of beater arms, which are held between flanged clamps on a prismatic shaft by means of transverse bolts.

An improved Counterfeit Coin Detector, patented by Mr. W. H. Rice of New York city, furnishes a convenient, compact and reliable device for pocket use, cash tills, etc. It has guide tubes gauged in length and width for coins of different denominations, in connection with a fulcrumed and weighted trip lever gauged to the weight of the genuine coins. A spurious coin if too large cannot enter the guide tubes, and if too light will fail to trip the trip-lever.

A new and useful Washing Machine patented by Louis Rivers of Auburn, Oregon, keeps the clothes supplied with fresh suds while being washed and also allows the dirty water to run off freely when squeezed out. By an ingenious combination of rollers, chains of slats, spring, etc., the machine washes the clothes, at a considerable saving of time and soap.

The forward end of an improved Last invented by J. R. Jacques of Hancock, Mich., is connected with the lower portion by means of dowels. The rear end of the upper portion is connected with a thumbscrew and the two parts are separated by wedges. This gives a simple yet strong construction.

A new Drawing Pen patented by Bethune Perry of Albion, Cal., makes a broken line instead of a dotted one. Upon the lower end of the handle is attached a spindle, upon the inner part of which is placed a sleeve to which a disk is secured. The middle part of the sleeve is fitted with a second disk which is held in place by a nut screwed upon the outer end of the sleeve. The two disks are placed with their concave sides opposite each other and are held apart by a rubber. Their edges have radial notches. By tightening the nut so as to prevent the sleeve revolving a continuous line is made; by loosening the nut, a broken line. A very useful implement for draughtsmen.

In an improved Sewing Machine Shuttle patented by H. J. Nott of St. Mary's, Texas, the shuttle case is fitted with a cap having a hook and catch for securing it to the shuttle, and a projection that holds the bobbin in place. The invention simplifies the operation of shifting bobbins and of threading shuttles.

A simple Button Swivel for connecting a tether with the ring of a head stall has been patented by Norman Brooks of Clifton, Kan. Upon the shank of the hook are two projecting arms forming a pivoted button. In using the device the button is turned lengthwise with the hook and passed through the ring of the headstall and the button turned sidewise.

In many Copying Books, the oil employed in making the leaves transparent soaks into the index and the back of the book, and spoils them. A new device has been patented by W. H. Ellis and W. McDonald of Brooklyn for obviating this. The body of the book consists of thin leaves, alternate ones being oiled to render them partly transparent. A half cover of enameled cloth is attached to the back cover which has elastic loops for envelopes. The index has a half cover of oilproof material to protect it from oil.

An improved Barrel Holder and Skid has been patented by G. W. Brown of Damariscotta, Me., which greatly facilitates the moving of barrels. The skid is made of two sections jointed and hinged so that they can be folded together, and is composed of cross bars and longitudinal bars rigidly connected together, so as to form an inclined plane. The upper section is hinged and pivoted inside of the curved side bars, forming a holding which receives and retains in place the barrel which has been rolled up.

An adjustable Switch for Ice Runs patented by H. F. Dernell of Athens N. Y., facilitates the handling of blocks of ice. At suitable points on both sides of the ice run flanges are omitted and lateral chutes constructed for conducting the ice into different houses, and fitted with flanged sides and grated bottom. The switches form a segment of a circle and are strongly braced.

A novel Top Prop for Carriages has been invented by Mr. Leonard Sawyer of Merrimac, Mass. The arrangement is such that the washers cannot turn on the bolt, and hence the nut and thimble will not be unscrewed by the action of the braces. The invention is an excellent method of securing parts very apt to work loose.

A simple and Automatic Wagon Brake is the invention of Messrs. W. L. Whitman and Ephraim Manes of Ringgold, Ga. The arrangement is such that the forward pressure of the wagon against the horses will apply the brake, while the wagon may be backed without the brake being thrown into action. The brake also acts as a clog to prevent the horses from starting.

Mr. Uel W. Armstrong of Evansville, Ind., has devised an ingenious Mosquito Net Canopy which consists of uprights to be attached to the bed which support a frame made in three pieces. The frame is easily folded into compact form, and the entire device may be quickly put up for use or taken down for storage. It has no detachable parts that are liable to get lost.

Mr. Henry Sutter of Baker City, Oregon, is the inventor of a new Breech-Loading Firearm in which one movement of the operating lever cocks the hammer, opens the breech block, and actuates the extractor, while the return movement of the lever closes the breech, locks the breech block, and pushes back the extractor. The barrels are fixed permanently in the stock.

A novel Vehicle Device for Checking Horses has been patented by Mr. Geo. L. Kenyon of Lonsdale, R. I. When it is desired to fasten the horse the end of the line is attached to a ring on a disk connected with the hub of one of the wheels. Should the horse start, the line is wound on reel arms and the bit pulled upon. Should the horse back, a pawl and ratchet connection prevents injury. This invention is both new and ingenious.

In a new Refrigerator patented by Mr. William P. Bradley of Mobile, Ala., there is a main box and an interior box forming an intermediate cold air space and closed by a water joint. The inner box contains ice chamber and water cooler, and by suitable devices the melted ice way may be drawn off. This refrigerator is claimed to reduce the consumption of ice to a minimum.

Mr. Frederick Dassori of New York city proposes a new Ceiling for Grain Vessels so as to make them safer and to protect the grain from damage or loss. The ceiling is carried up in a curve from water line to deck near the sides of the main hatchway and a lining of cloth or similar material is provided to prevent the grain sifting through and choking the pumps.

An improved Fire Escape that may be placed on the top or roof of a building and operated from below has been invented by Messrs. H. K. and Z. Warner of Lake City, Minn. On pulling a cord a catch is released, a platform drops, and a spool rolls down the chute thus formed and falls to the ground. A cord attached to this spool is now pulled and a rope ladder is thus hauled down. The object of the ladder is to furnish a convenient and readily adjusted means of access to the tops of buildings for the use of firemen.

A combined Sole and Toe protector for boots and shoes devised by Mr. Charles Nobs of Newark, N. J., consists of a sheet metal plate which covers and is screwed to the sole and has at its front end a tip portion. The object is to protect the sole and toe against wear and hard usage.

A new Meat Chopper by Mr. John C. Lloyd of Northumberland, Pa., embodies numerous ingenious improvements. The knives are adjustable so that they can be set forward as they wear, the springs may be adjusted so as to regulate the force of the chopping blow, novel contrivances rotate the meat box, and others turn the meat over to bring it into position to be operated upon by the knives.

Scientific Potato Culture.

A French agricultural journal, the *Basse Cour*, describes the result of some experiments in potato growing recently conducted by scientific men in Germany, in which it is demonstrated that the "eyes" at the top of the potato produce a much more vigorous offspring than those in the lower part, and the consequence is that those agriculturists who cut their potatoes in half before planting them are not well advised in cutting them vertically, but should always divide them horizontally, planting the upper half and using the other as food for cattle. But the best plan of all is to plant the tuber whole, cutting out, nevertheless, all the "eyes" except those in the top part.

Crystallized Boro-Manganese and the Action of Manganese in Blast Furnaces.

We find in *Comptes Rendus* a paper by Troost and Haute feuille upon manganese, from which we abstract a few points, such as may prove interesting to our readers.

Manganese combines with boron more readily than iron does, for in making ferro-boron, or boride of iron, crystallized boron must be employed, while in making the boride of manganese it is only necessary to fuse boracic acid with carburetted manganese, Mn_3C, in order to obtain this substance in small grayish violet crystals. Analysis of these crystals showed them to be a definite compound of 1 equivalent boron and 1 of manganese; hence its formula is Mn Bo. The crystallized boro-manganese, if free from excess of manganese, dissolves in acid with the evolution of hydrogen gas. When heated to redness in hydrochloric acid gas it is but slightly attacked; it decomposes water only at 212° Fah. Alkaline solutions attack it at somewhat lower temperature. In contact with moist mercuric chloride (corrosive sublimate), in a few minutes it yields manganous chloride, boracic acid, and hydrochloric acid. Mercury cyanide also attacks it in the presence of water.

In a previous paper the authors stated (*Comp. Rend.*, LXXXI., 264) that their researches had established the fact that carbon and silicon form with manganese definite chemical compounds, while these same non-metals unite with iron only at higher temperatures and form far less stable compounds. Hence it would be interesting to ascertain whether boron, which is generally placed in the same group with carbon and silicon, acts in the same manner toward iron and manganese. Experiments upon the amount of heat evolved by the decomposition of boro-manganese and ferro-boron with mercuric chloride show that both of these substances are chemical compounds. Hence boron does not make such a distinction between iron and manganese as do carbon and silicon. (Here is an important distinction between boron and silicon, which also differ in quantivalence.) Experiments were made with two kinds of ferro-boron; the one which contained 11 per cent of boron was somewhat malleable, that with 23 per cent of boron was not malleable, but brittle and crystaline.

There are similar distinctions and analogies in the compounds of sulphur and phosphorus combined with both of these metals. We know that small quantities of sulphur or phosphorus combined with iron do not destroy its metallic lustre, but alter its malleability and ductility considerably. The sulphuretted and phosphuretted iron, which cannot be considered as sulphides and phosphides, act quite differently when considered thermetrically. Two kinds of sulphuretted iron, one with 1·8 per cent of sulphur, the other with 5·4 per cent, when treated with moist mercuric chloride, evolved respectively 810 and 840 units of heat per gramme. The metal with 1·8 per cent of sulphur, which is quite considerable from a point of view, evolved the same quantity of heat as pure iron, while the other with 5·4 per cent sulphur evolves more heat than the latter. Iron containing phosphorus acts totally different. Two samples of iron, containing respectively 5 and 10 per cent of phosphorus, when treated with mercuric chloride, evolved 790 and 480 equivalents of heat per gramme. From this it is evident that the combination of iron with phosphorus takes place with a great evolution of heat, and that a permanent chemical compound is formed. The sulphuretted iron is comparable to the silicuretted iron, which is formed without scarcely any evolution of heat. We know, too, that sulphur is far more easily eliminated from iron than phosphorus. The sulphur and phosphorus compounds of manganese, prepared from manganese that contains carbon, are attacked with difficulty by moist mercuric chloride, which is a sign that they are formed with a great evolution of heat, and are therefore more stable compounds than the corresponding iron compounds.

The results of these and previous experiments upon the thermic relations of iron and manganese compounds leads to the conclusion that the manganese used in treating impure iron forms with the foreign substances compounds which are dissolved in and distributed through the mass of metal, and they render purification easier because they impart to the elements which are to be eliminated the oxidizability of the corresponding manganese compounds. At all events, this is frequently the case; but the manganese also plays another and simpler part, namely, it acts at the same time as the reducer of the oxide of iron.* In different metallurgical operations the elimination of the sulphur and and phosphorus, if carried far enough, requires a long protracted oxidation, which produces an iron which contains oxide of iron. By adding ferro-manganese, which is always rich in carbon, the necessary amount of carbon is added to the iron, and at the same time the oxide of iron is reduced with an evolution of heat, both by the carbon and the manganese.* The oxide of manganese produced is distributed through the metal, but does not impart to it the injurious properties that oxide of iron would, for it passes almost completely into the slag and takes the impurities with it. Hence, whether the manganese is already in the metal to be purified, or is added during the refining, its importance always consists, first, in the formation of compounds, the formation of which is accompanied by more evolution of heat than the corresponding iron compounds, and second, in the ease with which these compounds go into the slag, because they oxidize with the evolution of more heat than those which contain an equal quantity of iron, especially when, as is always the case in metallurgy, they are mixed with a large amount of the metal in excess.

*Not only have manganese and carbon the power of reducing the oxide of iron in molten iron, but silicon likewise will perform this function, and but for the danger of introducing an excess of silicon, which would then remain unoxidized to the detriment of the iron, this element could be substituted for manganese in the Bessemer process, by making use of ferro-silicon instead of ferro-manganese. The question of the practical use of silicon in metallurgy cannot be considered settled yet, and offers an interesting field for investigation.

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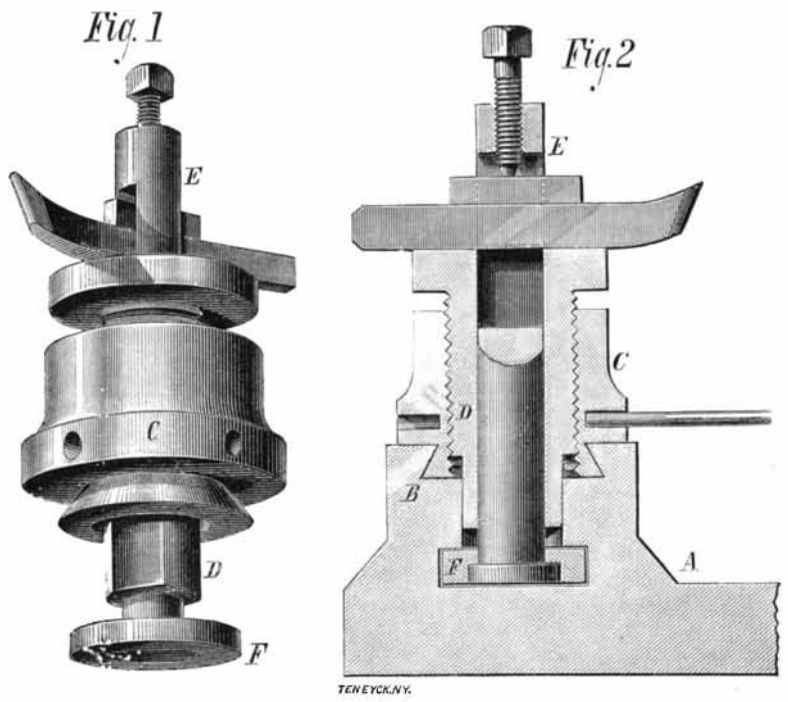
IMPROVED TOOL POST FOR LATHES.

We illustrate herewith a new tool post for engine lathes and similar tools in which the support is made in two parts, the upper part being screwed into the lower one and capable of being raised or depressed by turning said lower portion. The lathe tool is clamped by a set screw in the post in the usual way. Fig. 1 is a perspective and Fig. 2 a sectional view of the device.

A is a portion of the tool carriage of a lathe which is provided with the usual T-shaped slot, and with a V-shaped grooves, B, at the sides of the slot. C is a nut having a V-shaped flange to fit in said grooves, and turning therein. To the nut, C, an external sleeve, D, is fitted, which is flattened at its lower end and inserted in the T-shaped slot. It also has a flange at its upper end for supporting the tool. The post, E, has the usual mortise to receive the tool and set screw for binding the same. At its lower end a plate, F, is fitted and enters in the wider part of the T-shaped slot. By turning the nut, C, by means of a lever inserted in one of the holes made in the nut for the purpose. The sleeve, D, is raised or lowered as may be required, and the tool is clamped upon the top of the sleeve by the set screw in the post.

The device is of strong construction and the tool is rigidly held, while at the same time being easy of adjustment.

Patented through the Scientific American Patent Agency, October 2, 1877. For further particulars address the inventor, Mr. Robert Neasham, Mount Washington, Pittsburgh, Alleghany county, Pa.



NEASHAM'S TOOL POST FOR LATHES.

To Transfer Engravings on Glass.

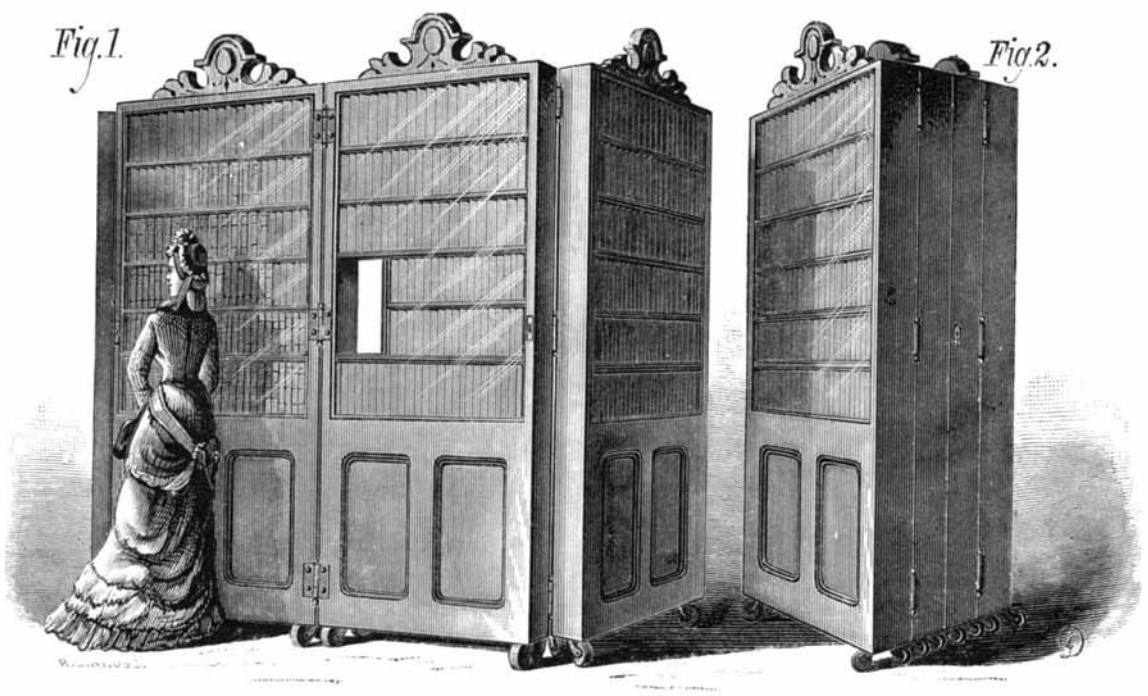
Metallic colors, prepared and mixed with fat oil, are applied to the stamp on the engraved brass or copper. Wipe with the hand in the manner of the printers of colored plates; take a proof on a sheet of silver paper, which is immediately transferred on the tablet of the glass destined to be painted, being careful to turn the colored side against the glass; it adheres to it, and so soon as the copy is dry take off the superflous paper by washing it with a sponge; there will remain only the color transferred to the glass, which will be fixed by passing the glass through the ovens.

HILL'S FOLDING BOOK CASE.

The folding book case, of which we present two views, consists of a central section and two end sections hinged to the former at the rear edge. The upper portion of each section of the case is divided by a series of horizontal and vertical partitions, into small compartments, each intended to receive a book, and each numbered to correspond with the number of the book for which it is the receptacle.

In front of these compartments each section is glazed. The books are arranged within with their backs to the front, so that the titles can be discerned through the glass. In the lower portion of each section are large compartments for books, papers, etc. The library is used by placing the side sections at right angles to the central section. The librarian stands in the inclosed space, removes books from the back and passes them through the aperture indicated in Fig. 1, to the applicant. Fig. 2 shows the book case folded up when not in use. The books are thereby protected from injury by dust, and the case itself is easily stored away, and being provided with strong casters is readily moved.

The invention is especially intended for circulating and Sunday school libraries, but would also be a convenience in private houses. For further particulars apply to the inventor, Charles F. Hill, Hazleton, Pa.



HILL'S FOLDING BOOK CASE.

On Bleaching Shellac.

BY JOSEF MARIA EDER.

The greater part of the colorless shellac which is used is bleached in the alcoholic solution, because these varnishes give a good polish, and warrant that the metallic articles covered with them will remain bright. There are, however, in the market considerable quantities of solid bleached shellac, and its practical preparation is not unimportant.

The method of bleaching with alcohol and chloride of lime, given by Field in the *Polytechnisches Notizblatt* (1852, p. 23), and by Wittstein in *Dingler's Journal* (1857, CXLIII, 467), as well as those of Lunning and Elsner, with alcohol and animal charcoal, are not applicable to solid shellac owing to the high price of alcohol and the difficulty of its recovery. Kressler's method is more practical, in which the shellac is dissolved in aqueous soda solution and bleached with hypochlorite of soda. Sauerwein modified Kressler's process by the addition of sulphite of soda to the above named reagents.

According to my experiments, the following process is practically especially to be recommended, and can also be carried out on a large scale, according to my directions.

Ten parts of pulverized shellac is dissolved with four parts of crystallized soda in 120 to 150 parts of hot water in a copper kettle, and the violet solution, the color of which is due, according to Marquart and Nees Von Esenbeck, to a coloring substance similar to carmine, is filtered through linen into a wooden vat. Ten parts of chloride of lime (containing about 30 per cent chlorine) is triturated with a solution of 10 to 20 parts of crystallized soda in 200 of water, and this bleaching solution filtered into the shellac solution. To the mixture when cold, dilute hydrochloric acid is added carefully until some shellac begins to separate in crumbs: in most cases only a very little acid is required. This little dodge, suggested by Sauerwein, in fact, hastens the bleaching in no small degree. After two or three days, whether the solution is kept in the dark or in the light, the bleaching is finished. The shellac is then precipitated by the addition of concentrated hydrochloric acid.

If a comparatively pure natural shellac is to be bleached, this white crumbly precipitate is at once collected upon coarse linen, thoroughly washed with frequent stirring, and then melted together. Impure shellac is left standing for several hours in the liquid, after having been precipitated with hydrochloric acid. The liberated chlorine acts very energetically; yet it is preferable to allow the bleaching to proceed in the alkaline solution. The finely divided shellac, if it remains very long in the acid chlorine solution, becomes brittle, and cannot be drawn out so well. Inferior grades of bleached shellac are obtained by using half the quantity of chloride of lime above prescribed.

The precipitated shellac is put into boiling water, when it becomes soft, and can be moulded in any desired form. At first it is porous and not transparent, but repeated warming, and strong kneading and pulling, impart to it a beautiful silky gloss.

In spite of the greatest cleanliness, which is absolutely necessary, it is scarcely possible to prevent the surface becoming yellowish; if the bleaching did not succeed perfectly the whole mass has a yellowish shade. To improve the appearance of the ware, the drawn and moulded shellac is put for some 24 hours in the acid chlorine liquid, from which the precipitated shellac has been strained out. It is used before being diluted by the wash water; if necessary, some more chloride of lime is added. By this means a chalk white surface is obtained. This white layer also possesses this advantage, that the shellac can be kept a long time without changing its appearance; for it does not change, as all bleached shellac will, and that too throughout the whole mass. Finally, the silky lustre is greatly enhanced by brushing the surface. This silky appearance cannot be obtained by chemical means. According to Berzelius, by a short immersion in strong ammonia, the surface swells, and when dry, has a strong lustre, but instead of being silky i is resinous. The white color of product changes under this treatment to yellowish, and cannot be restored by the above mentioned process of after-bleaching.

The shellac thus prepared dissolves rapidly in alcohol, and the solution is perfectly colorless. Previous swelling of the shellac in ether is superfluous. With freshly bleached shellac, a milky turbid varnish is frequently obtained, which does not clear on standing a long time, as observed by Jacobsen and Peltz. The cause of this is the insolubility in alcohol of a resin which is contaminated in the crude shellac, as shown by Unverdorben (*Pogg. Annalen*, XIV, 119), and by the wax in the shellac (*Ann. Pharm.*, CXXXI, 286). The method proposed by Peltz, of extracting this substance with petroleum ether, I do not consider commendable, for the reason that such varnish dries brittle. Shaking the solution with pulverized chalk, or gypsum, accomplishes the clarification in a few hours, and the clear solution can readily be drawn off.

Polish prepared with such bleached shellac is more brittle than if it is bleached with spodium, and hence the latter is to be preferred for fine cabinet work. On the other hand, if the shellac is only sufficiently washed there is absolutely no rusting of metals varnished with it.—*Dingler's Journal.*

A Brilliant Meteor.

To the Editor of the Scientific American:

Thinking it to be of interest to you, I send you the following description of the fall of a meteor which I observed last evening, November 11, 6.30 P.M. Direction N. N. E. Altitude at commencement of course about 30°. Length of course from 10° to 12°. Time of falling about 8 seconds. It fell towards the west, making an angle in falling to the earth of about 65° with the vertical passing through the body. During the latter three fourths of its course, its length, including the luminous trail, was about one half of a degree. The nucleus was very brilliant; its color at first a yellowish-white, then a light green, and lastly a greenish yellow. Could its color have been due to boron, thallium, etc.? I find no record, in any of the numerous analyses of meteoric stones, of the presence of elements likely to give the green color.

ROBERT C. HINDLEY.

Racine College, Wisconsin, November 12, 1877.

Kangaroo Leather.

Kangaroo hides have already become an important article of export from Australia. They make the most pliable leather that is known, admirably fitted for bootlegs, gloves, and riding whips. The skins are sent to Europe, some tanned, and some simply dried.—*Fortsch. d. Zeit.*

A GOOD waterproof cement may be made by mixing glue 5, rosin 4, red ocher 3 parts, with a little water.

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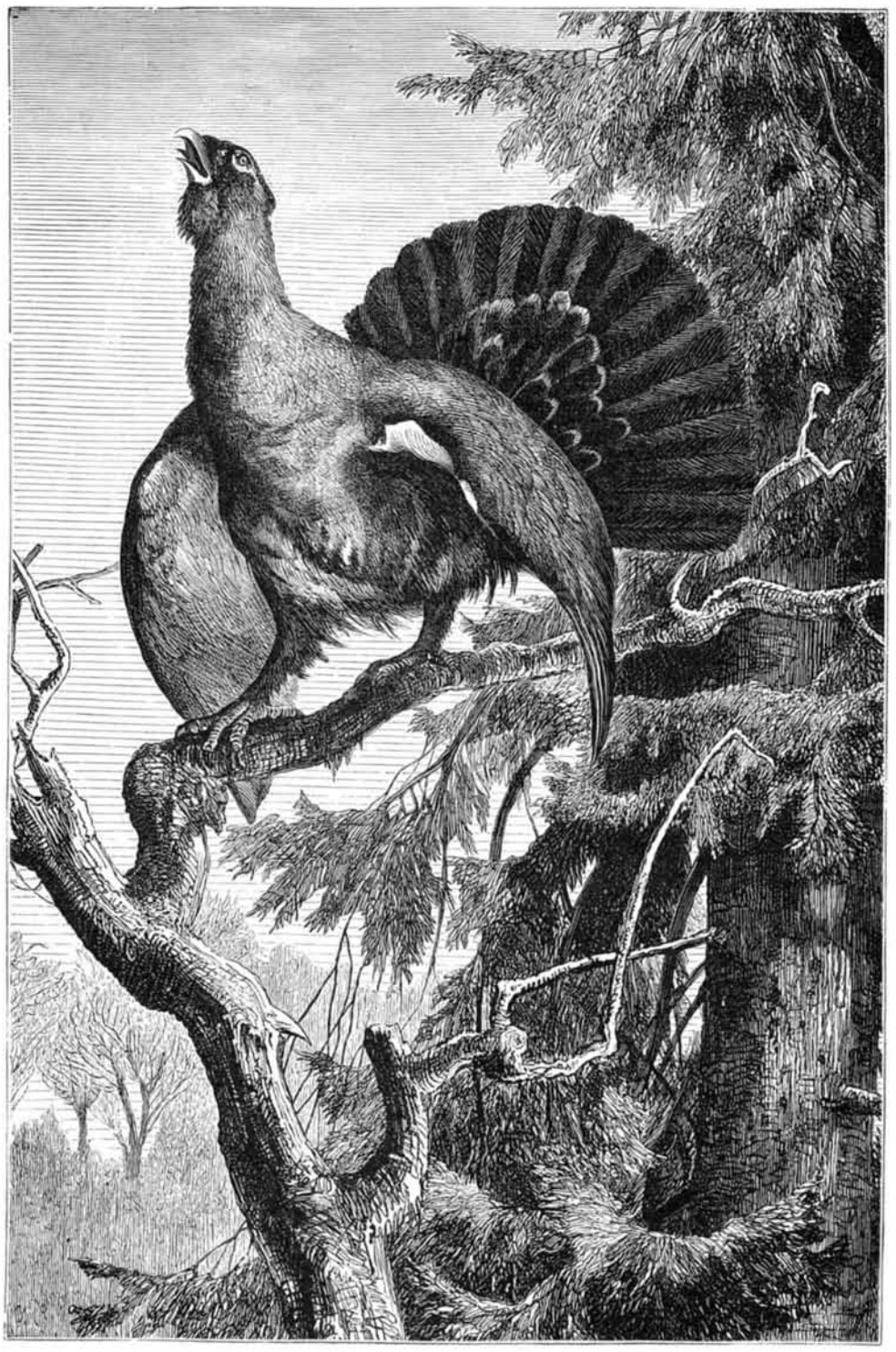
THE CAPERCAILZIE.

The capercailzie, or cock of the woods (*petrao urogallus*), is one of the largest and finest members of the grouse family. In size it is nearly as large as the turkey. The color of the male bird is a rich chestnut brown covered with a number of black lines irregularly disposed; the breast is black with a gloss of green, and the abdomen is simply black, as are also the lengthened feathers of the throat and tail. The female is distinguished by bars of red and black, which traverse the head and neck, and the reddish yellow barred with black of the under surface. The bird was once a common inhabitant of the highland districts of Great Britain, but in that locality it has become very rare, its habitat being restricted to the northern parts of the continent of Europe, Norway and Sweden.

The engraving of the capercailzie, given herewith, represents a male bird uttering the curious calls which it makes during the pairing season. Stationing itself on the branch of some lofty tree, at sunrise or just after sunset, it droops its wings, ruffles its feathers, and spreads its tail, like an angry turkey cock. The call is represented by the syllables "*peller peller*," and these are repeated at first at some little intervals; they gradually become more rapid until at last, after the lapse of a minute or two, the bird makes a sort of gulp in its throat, and finishes by a strong inhalation of the breath.

The nest of the capercailzie is made on the ground and usually contains from eight to ten eggs. When hatched, the young are fed upon insects, more especially ants and their pupæ. The adult birds feed mostly on vegetable substances, such as juniper, cranberries, and the leaves and buds of several trees.



THE CAPERCAILZIE.

Arsenic in Vulcanized Rubber Stoppers and Tubes.

It is well known that vulcanized rubber is unfit for several kinds of experiments, such as where it is required to determine the sulphur in gases and other substances, where the rubber may give up some of its sulphur to vitiate the results. Filhol has also found arsenic in rubber stoppers, which makes them unfit for use in testing for this poison. In Schneider's test the arsenic is converted into the volatile arsenious chloride by distilling the substances with a mixture of common salt and sulphuric acid. In making this test, in a flask closed with a perforated rubber stopper, through which the gas delivery tube passed, he found sulphur in the distillate. He suspected that the arsenic was derived from the rubber stopper, and therefore repeated the test without the use of any rubber, and found no arsenic. He also found that hydrochloric acid gas, when passed through vulcanized rubber tubes, also took up perceptible quantities of arsenic. The author does not state the color of the tube nor name of manufacturer, which is of some importance, as the arsenic was probably an accidental and not intentional constituent of that particular rubber, and was contained in the sulphur.

Burning Iron Castings Together.

The usual mode is by imbedding the castings in the sand, having a little space left vacant round about the joint where it is to be burned. Two gates must then be provided, one lying on a level with the lower side of this space and the other raised so that the metal; which must be very hot, is poured in at the higher one; it passes round, fills the space, and runs off at the lower gate. A constant supply of metal is thus kept up, till the parts of the casting are supposed to be on the eve of melting. The lower gate is then closed. and the supply stopped. When cool, and the superfluous metal chipped off, it forms as strong a joint as if it had been original.

Printing Pictures from Prints.

The page or picture is first soaked in a solution of potash and then in one of tartaric acid. This produces a perfect diffusion of crystals of bitartrate of potash through the texture of the imprinted part of the paper. As this salt resists oil, the ink roller may now be passed over the surface, without transferring any ink except to the printed part.

A LITTLE alum added to saffron in soft hot water makes a beautiful yellow ink.

Improved Air Pump.

In a new form of the Sprengel air pump, described in a paper at the British Association by C. H. Stearn and J. W. Swad, the mercury reservoirs at the top and bottom of the pump are closed, so that the external atmosphere exerts no pressure on the surface of the mercury contained within them. In consequence of this the fall-tube may be much shortened while the efficiency of the instrument is retained. At the commencement of the exhaustion of a receiver the mercury supply reservoir is filled to the top and closed by a stopper; a small exhausting syringe attached to the reservoir at the bottom of the fall-tube is then set in action, which removes a considerable portion of the air from the receiver to be exhausted, and also very much reduces the pressure on the mercury in the lower reservoir; the flow of mercury through the pump rapidly completes the exhaustion. A small vacuum tube with aluminium wires a quarter of an inch apart was exhausted in twelve minutes to such an extent that an induction coil, giving sparks half an inch long in air, failed to produce the faintest luminosity, the fall-tube of the pump being only nine or ten inches long.

Restoring Burnt Cast Steel.

The following recipe has been well recommended: Borax 1½ lbs., sal ammoniac ½ lb., prussiate of potash ½ lb., resin 1 oz. Pound these ingredients finely together, add a gill each of water and alcohol, and boil all to a stiff paste in an iron kettle. Do not boil too long or it will become hard when cool. The burnt steel is dipped while hot in the composition and slightly hammered.

Plaster Casts.

Not long the Prussian Ministry of Commerce and Manufactures offered prizes for the best and most simple methods of so treating ordinary plaster of Paris casts, by chemical or other means, as to render them capable of being washed, and at the same time to close the porous surface of the plaster, that dust might not penetrate its mass.

Plaster casts, even after having been thoroughly treated with stearin, are soluble in water to a very considerable degree. One need but tint the water with bluing or some similar color, and the gradual softening and solution of the plaster can be readily followed by the eye. A more striking illustration is had by stirring together a thick cream of plaster with gelatin previously treated with chromic acid, and letting them harden. When soaked a while in water the plaster wholly disappears, is dissolved away, and leaves a sponge-like substance of the insoluble gelatin. From these experiments it is seen that plaster casts, though saturated with stearin, should never be washed.

A method hitherto much used is to paint the plaster with oil color; but, apart from changing the appearance, the paint fills up the cavities, and, especially when the cast is a relief, blurs and destroys all its delicacy and exactness. On architectural plaster ornaments for interior decoration, capitals, cornices, etc., painting may be tolerated; but on all reproductions of sculpture, even a single coat of paint is inadmissible. Dr. Reissig, of Darmstadt, has, by two different processes, succeeded in transforming plaster of Paris into chemical combinations entirely insoluble, not only in water but in soft soapsuds. The first method, simplest and cheapest, is based on the fact that sulphate of lime (plaster of Paris) is changed by baryta water into sulphate of baryta, and a caustic lime gradually transformed by the action of the air into a carbonate of lime, as we know from the similar action in plaster and mortar. Baryta water is prepared by slacking together in a securely corked bottle, one part crystallized hydrate of baryta, with about twenty parts rain water, thus forming a saturated solution. After it has cleared, it is sponged or is poured over the plaster as long as this continues to absorb it. If after the cast has been dried by a moderate heat, the plaster continues to accept the wash, the sponging may be repeated; but this is seldom the case. This treatment, besides hardening the cast, gives it a whiter and clearer appearance.

The second method consists in changing the sulphate of lime, by the use of a weak alkaline silicate of potash, into lime, an exceedingly hard and durable substance. To obtain the potash silicate, water containing about ten per cent of caustic potash (pure and free from iron) should be heated to the boiling point, when so much silicic acid is added as will dissolve itself therein. In cooling, pipe clay and silicate of potash are generally precipitated in some degree. The liquid should be preserved in corked bottles until entirely clarified. Immediately before its use a small piece of pure potash should be thrown into it; or in its place, one or two per cent of potash may be added. The silicification itself is effected by dipping the plaster for a moment into the bath thus prepared; or, if the cast is immovable, by applying it with a sponge or an atomizer. When the surfaces to be covered are large, the liquid may be diluted with rain water. After the almost instantaneous chemical change has taken place, the superfluous solution should be carefully removed by washing with soapsuds. Some little experience is necessary to decide the exact time of exposure to the solution of this second method; but by practice it may soon be judged by the smoother and firmer appearance of the plaster, and by its hardness as felt by the finger nail. The fresher the plaster, and the more porous the cast, the more quickly should the bath be employed. Casts made of old plaster cannot be silicified to advantage. After having been treated by either of these processes, plaster of Paris casts will not be in the least dissolved by washing with water or soapsuds: but, though their surfaces are no longer sulphate of lime, yet they still retain their original porous nature, and readily absorb dust and the dirty water of the first washing. To obviate this, they are finally coated with an alcoholic solution of common soap, which, after the evaporation of the alcohol, entirely stops up the pores, and much facilitates the washing. It may be prepared by dissolving one part of bar or Castile soap in ten or twelve parts of alcohol; or it may be had of apothecaries under the name *spiritus saponatus*. This latter, however, is generally prepared with alcohol of a low grade. A little more expensive, but much better filling, is to be had by dissolving steatite of sodium in pure spirits of wine; this gives a really beautiful transparent tone to the plaster, and is highly to be recommended. The application of both is the same, it being necessary, if possible, to warm the cast, that the solution may be well absorbed; a repetition of the process is desirable. With the evaporation of the alcohol the operation is completed; the cast is in effect vitrified without coating its surface.

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THE PROBOSCIS AND LANCETS OF THE STABLE FLY.

BY J. MICHELS.

During one of the annual plagues of the house flies, I was much surprised to notice one of these little creatures escape from my hand, which had just received quite a sharp wound, such as would be delivered by some lancet-bearing dipterous insect.

Being very familiar with the anatomy of the common house fly (*musca domestica*), and knowing it to be incapable of such an act, I determined to secure the next specimen that informed me of its presence in this emphatic manner.

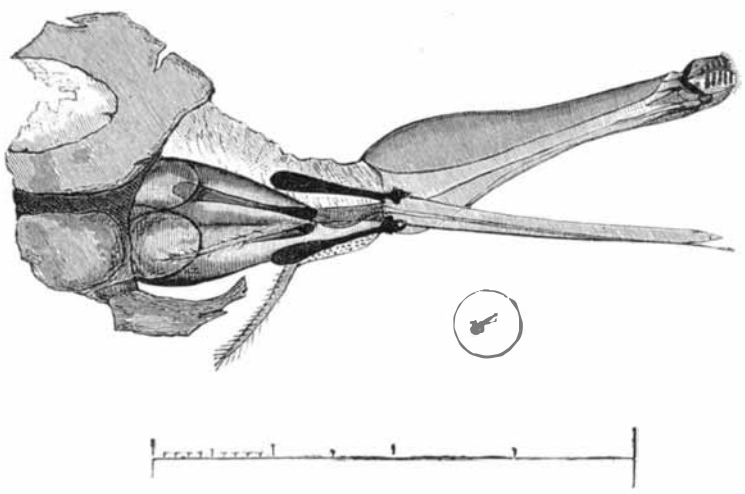
The following day the opportunity came, and when my little visitor had recovered from the alarm caused by the rather sudden withdrawal of my hand, he soon returned when my wrist was courteously placed at his disposal, and he now, without interruption, leisurely regaled himself at my expense.

I now made my observations and found that, although the fly closely resembled and, to the casual observer, would probably be mistaken for one of those with which we are all but too familiar, and whose apparent hostility to the nervous, the irritable, and bald has furnished "Leech" and other caricaturists with a subject for many a sketch, still, on closer observation, the well known proboscis of the house fly, terminating with a lobe, was absent, and in its place a sharp pointed tube-like instrument was seen.

Death by an overdose of chloroform, followed by a dissection of the parts that appeared novel, was soon accomplished, and the same, after proper preparation, permanently mounted in balsam in the usual manner.

A microscopical examination, with a good 1 inch objective, at once revealed the formidable nature of the apparatus at the command of this innocent-looking fly.

As a good drawing saves a long description, I offer one made by "*camera lucida*," which faithfully represents the proboscis and lancets thus prepared, the object in the small circle showing its real size.



THE PROBOSCIS AND LANCETS OF THE STABLE FLY.

I would direct attention to the strong bayonet-looking lancets, and the powerful muscular levers that propel them at the will of the insect; these lancets, called "*setæ*," vary in number from 8 to 2. After dissecting many specimens of the fly in question, I never observed more than two. The proboscis is doubtless a powerful sucking apparatus, the ferocious-looking jaws with which it terminates being arranged to expand and fasten upon the wound made by the lancets.

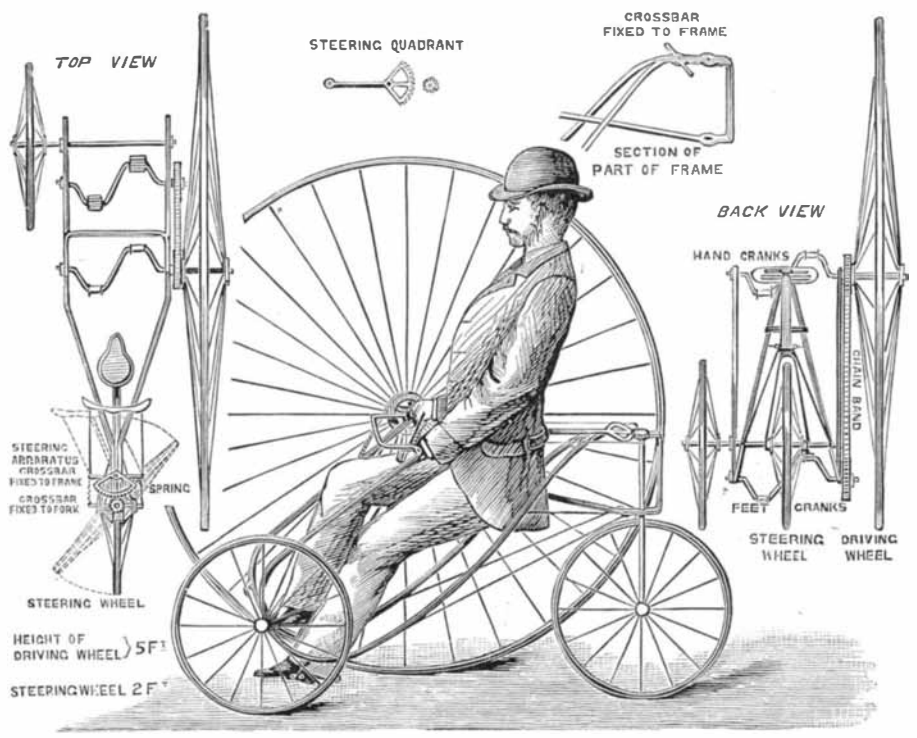
The brush-like appendages, called "*maxillary palpi*," will also be noticed, one of which, in the drawing, is somewhat hid at the base of the proboscis.

I apprehend this fly is the stinging stable fly (*stomoxys*) which sometimes goads horses almost to madness by their severe and incessant punctures. They are clearly not particular in their diet; and wandering into private dwellings and horse cars, attack the first they approach.

IMPROVED TRICYCLE.

We select from the *English Mechanic* the accompanying sketch, with its details, of the Bradford tricycle. It is operated by both hands and feet. The feet rest upon cranks that drive a shaft placed in the lower portion of the framework, and as this shaft is rotated, it communicates motion by means of a chain band to the large 60 inch driving wheel. The shaft of this driving wheel has two cranks, which, being engaged by the hands of the rider, materially assist locomotion. A steering wheel 24 inches in diameter is placed in the rear, being attached to a vertical rod; its upper end being provided with a small gear wheel meshing into the geared arc of a lever, the opposite end of which, formed like a fork, partially encircles the body of the rider. By inclining the body to the right or left, this lever, turning on its pivot, produces a corresponding turning of the steering wheel.

By the arrangement of the tricycle, it may be propelled by either hands or feet, at the option of the rider, or the simultaneous action of both hands and feet may be employed.



THE BRADFORD TRICYCLE.

Separation of Nickel and Cobalt.

The separation of nickel and cobalt has hitherto been a somewhat difficult operation, but by the new method, which I made known a short time ago, this is effected easily and rapidly. The following method of detecting and isolating minute quantities of nickel in commercial chloride of cobalt, supposed to be pure, will give an idea of its practical nature: A few grains of that salt are dissolved in water, and the whole of the cobalt precipitated, with the nickel, by xanthate of potash employed in slight excess, and previously dissolved in a little distilled water. A few drops of ammonia are then added, just sufficient to render the liquid slightly alkaline, and the dark green xanthate of cobalt is collected on a filter. The whole of the nickel is in the filtrate, and the whole of the cobalt in the filter. The nickel in the filtrate is precipitated by a few drops of sulphide of ammonium.

Character of xanthates.—Besides the yellow precipitate which the soluble xanthates give with salts of copper, all the insoluble xanthates, on dissolving in nitric acid, give rise to nitrous ether, which is readily recognized by its odor. —*Dr. T. L. Phipson, in Chemical News.*

Repairing Gas Bags.

When small leaks occur in bags used for gas to supply a magic lantern, they can be closed with thick boiled glue mixed with glycerin, in the proportion of 1 part of glycerin to 4 of glue, applied warm to the bag while filled with air. If too much glycerin is added the cement will be sticky, which can be overcome by strewing powdered soapstone over it; if too little glycerin is added, it is too hard. If the holes or rents are large, the glue is made quite stiff and applied to strips of soft leather and this applied as a patch. Glue is better for this purpose than caoutchouc or gum.

New Mechanical and Engineering Inventions.

An improved form of Tubular Bridge has been devised by Mr. George E. King, of Des Moines, Iowa. The posts, counter braces, and lateral braces, are connected to a tubular arch by pins passed through angle irons rigidly secured to the arch, and also to eyes formed on the posts and braces. The advantage of this arrangement is that the tube is not weakened, nor so perforated that moisture can enter between the joints of the plates.

In the Manufacture of Twist Drills, it is required to clear them or reduce them in diameter from the cutting edge of the spiral. The drill is held in a spindle. A finger engages the spiral slot in the drill as the latter is moved downward, so that it is always kept in proper relation with the cutter, the inclination of which may be varied as desired.

Messrs. George and Samuel Isaacs, of New York city, propose a new Rail Cleaner for cars, which consists of improved bushes, which are held down by levers, upon the track in front of the wheels. Arrangements are provided to prevent the brush head turning out of true, and the tufts are so fastened in the heads that the bristles are prevented from becoming cut or broken. This device is well suited for use on street cars.

An improved Hand Loom has been devised by Messrs. W. P. Clements and Jas. H. Cagle, of Davidson River, N. C. The new features include a shuttle box and throwing apparatus, and a new heddle construction. When the batten strikes the cloth, the weight of the shuttle and clamp piece relieves all pressure from the shuttle, so as to facilitate the throwing of the same, and the arrangements are such that when the operator has to stop, to tie a thread or for any other cause, he can instantly go on with the work without being required to find the treadle in which he left off work.

An improved Pipe and Bar Cutter, which cuts off the pipe or bar very quickly and smoothly, has been patented by Mr. Jesse Astall, of Galveston, Tex. By simply turning a hand nut the cutter is fed forward. There is a device for holding the pipe very securely as the piece is cut off.

A new Zinc Smelting Furnace has been devised by Mr. Octavius Lumaghi, of Collinsville, Ill. The new feature consists in constructing the back wall of the furnace with holes through it. Removable plates are provided in combination with retorts through their butt ends, for allowing a circulation in them when desired. In smelting, all that can be got in the form of spelter is thus obtained, and then all the zinc that remains in the retorts in the form of oxide is extracted.

Mr. James Craik, of La Cross, Wisconsin, proposes a new Bail and Driver for Millstones, which carries the stone with a positive motion, and at the same time permits the stone to poise itself with the utmost freedom on the top of the spindle. The construction is both simple and ingenious.

A new Car Brake, devised by Mr. Jacob J. Anthony, of Sharon Springs, N. Y., comprises a cylinder containing pistons, which are forced apart by steam, water, or air, under pressure. By this means levers are moved so as to force the brake shoes against all the wheels simultaneously, and with an equal pressure on both sides of each wheel.

A new Leather Rounding Machine has been devised by Mr. Thomas S. Reed, of Calais, Vermont. The upper roll has one of its journals supported in a pivoted and the other in a sliding box. This facilitates the purpose of the machine, which is gradually to compress the leather by passing it through different grooves until it has attained the required diameter.

For moving cars about in car shops, yards, etc., over short distances, Mr. Andrew Lebus, of Flora, Ill., has contrived a simple and powerful Jack. A clamp is secured to the car sill, and a plate having a V-shaped notch is applied to the rail. A lever is then moved, throwing a rod forward, which propels the car. The lever is then moved backward, the plate takes a new hold, and the operation is repeated. This invention will doubtless prove of much utility.

A new Ballast Distributing Car, for ballasting a railroad track with broken rock, gravel, sand, etc., has been devised by Mr. Adam B. Dockstader, of Sherman, Tex. In the bottom of the car are a number of spouts, which are closed by a series of pivoted boards, which may be moved simultaneously by a lever from the platform. With this construction the ballast can be discharged as desired while the train is in motion. This will doubtless materially facilitate labor.

A novel Mail Bag Catch, for taking mail bags and delivering them from a car while the latter is in motion, has been patented by Mr. George F. Shaver, of Westfield, N. Y. A rod on the car seizes a bag suspended from the roadside crane, while another rod on the latter, at the same time, takes a bag suspended from a frame attached to the car. The bag entering the car slides inward and strikes a curtain, so that it is subjected to no injurious shock.

Those of our readers who may desire further information concerning any of the above described inventions, can obtain the same by communicating with the inventors at the addresses named.

New Building Inventions.

A novel Eaves Trough Machine, devised by Mr. William J. Barber, of Covington, Ind., forms the trough of metal by causing the sheet to pass through suitably shaped rollers, which give it the necessary turns and beadings. This is a very simple and ingeniously constructed machine.

A new Vault Cover and Railing has been invented by Mr. Clarence H. Straight, of Bryan, Ohio. It consists of racks, which may be turned downwards to rest upon the pavement or floor, and so to close the opening, or to turn upwards to serve as a railing for the same.

For Holding Window Sashes in any desired position, Mr. Zelotes Curtis arranges toothed eccentric cams, that are pivoted to the casing of the fastener and operated by bell crank levers, which turn on a common pin, and are acted upon by a spiral spring. This device retains the sash securely and is very easily operated.

Mr. Daniel T. Keeffe, of Glens Falls, N. Y., also has devised an improved Sash Holder, which sustains the window at any height without the use of cords or weights. A roller is provided with a flanged bearing frame that is acted upon by a helical spring. This is combined with a screw-threaded plug, which enters the casing. The roller, by friction, holds the sash as desired.

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Those of our readers who may desire further information concerning any of the above described inventions, can obtain the same by communicating with the inventors at the addresses named.

SCIENTIFIC AND PRACTICAL INFORMATION.

BY MR. T. C. PLELSEY, OF IQUIQUE, PERU.

NEW SOURCES OF SUPPLY FOR TANNING MATERIAL.

The Liverpool Chamber of Commerce recently stated that the supply of material for tanning leather was falling short in England, and called for information as to where fresh sources of supply might be discovered. In the province of Baldivia, in Chili, there exists almost impenetrable forests of trees of considerable variety, among which there are not only such (as the "lorontilla" and the "ulma") as would make a splendid addition to the beauty of English—and other moist temperate climates—parks and gardens, but great numbers of a fine large tree, the "luigue," considered to be a species of oak, the bark of which is used for tanning leather at a German tannery of some importance, long established on the river bank opposite the city of Baldivia. It might be profitable to search in that locality for the required supply of tanning material, as there is a good prospect of success, and the certainty of finding other elements both of utility and ornamentation. Inducements are held out by the government for colonization, and labor at present is not dear.

PREPARATION OF BROMIDE OF AMMONIA.

Place in a good sized bowl containing some liquid ammonia a teacup containing bromine, covering all with a sheet of glass. The bromine vapors first settle down, and are followed by the more expansive ammonia; they become rapidly converted into the bromide, whose pure white crystals form round the edges of the bromine. The whole operation only occupies a few minutes.

PYROXYLIN.

Finding, after taking every precaution to rid my gun cotton of acid, that the sensitizers employed with the collodion I made with it underwent slow decomposition, I resolved to boil it, when I found that after the acid flavor disappeared an intense bitter principle became extracted by the operation. Washing well then, between each boiling, I continued the latter until the bitterness gradually diminished, and after some twenty odd boilings disappeared. The collodion made with this was always stable, it did not discolor, even by exposure to the light, and worked well to the last drop, even after being kept for years. Pyroxylin made with mixed acids only, I presume, would not require this treatment. I made mine with a mixture of sulphuric acid and nitrate of potash, and am persuaded that the source of the annoyance was the resulting sulphate of potash which formed in the fiber of the cotton. The cotton thus prepared has the ad vantage of so high a degree of solubility that it is possible to make and sensitize collodion and take a good negative with it within an hour.

QUICK CAMERA PRINTING.

Photographs for subsequent painting on in oil may be prepared by floating the prepared and sensitized surfaces with a pyrogallic and acetic acid developer before exposure. The operator is thus enabled to see his pictures coming out, and stop them at the right stage for fixing. This has been attended with the most satisfactory results. It is only necessary to have a lighted candle in the room, stationed behind the canvas, and, covering up the mouth of the camera, approach it occasionally to note progress. Life-sized pictures, or thereabouts, from ¼ plate negatives, require about 30 seconds to print suitably.

DURABLE AND STEADY QUICKSTUFF FOR DAGUERREOTYPING.

Slake quicklime with water until it is so completely hydrated as to remain quite damp—as far, in fact, as possible, just to avoid actual coherence between the particles—and saturate with bromine charged with a sixteenth part of pure iodine, when it will be found to coat, after iodizing the silver plate to a light rose, in from ten to twenty seconds in the mild temperature required in a daguerreotype gallery; work with great steadiness, in spite of considerable variations in temperature and frequency of drafts during the day upon the vapor; give beautiful, delicate, bright, clear, vigorous impressions, allowing of a full strength solution of hyposulphite of gold to fix; and work equally well for months without the necessity of renovation. The plates thus prepared require about one fourth the time over the iodine bath, for the second as compared with that occupied by the first coating. This method admits of considerable latitude to the operator, so as to modify, without prejudice to success, the character of the results obtained, the proportion of the iodine to that of the bromine, may be varied, or chloride of iodine even used instead, for mixture with the bromine (though with the latter I was not quite as well satisfied); but the hydrate of lime must be as stated in order to obtain the full benefit of the process.

AN ICE MONOPOLY.

The high degree of temperature experienced throughout a great portion of the year in Chili and Peru would seem to point them out as good fields for the exportation of such machines. It is well, therefore, they should be advised that such restrictions are placed on the trade in ice or frozen snow, which have been made the subjects of a monopoly by the municipalities that no one is permitted to supply the articles except with the consent of these bodies, and after paying very heavy demands, according to the importance of the locality, for the privilege.

SOFTENING STONE.

I have seen some ingenious laborers on the Oroga railway, who had made a contract for excavation in very hard ground, make a good thing of it by digging a narrow trench and leading water on to it. There are certain kinds of metallic ores which, from their hardness or toughness, are tedious and troublesome to pulverize, yet which, from the fact of their containing saline or other more or less soluble or easily softened constituents, might be advantageously treated by immersion for a time in water, previous to grinding. It is known that the stones in the old palace of the Incas in Cuzco fit so closely together, without any binding material, as not to admit a knife edge between them; and it has been supposed that they were possessed of the secret of softening the surface of stone preparatory to working it. A circumstance which has come to my knowledge gives a coloring to this supposition. A friend of mine, travelling a long way into the interior to the north of Peru, came across an Indian who was engaged in making a preparation for the purpose of softening some silver ores he was working. It consisted of urine, the juices of the leaves and stalks of three kinds of plants, and those extracted from the roots of two others. The leaves of one of the plants were about a foot long, and resembled those of the common dock leaf. This was all he was able to ascertain, as the Indian was chary of communication, and took pains to conceal the elements of his preparation.

THE IQUIQUE EARTHQUAKE.

Iquique was not "destroyed" by the earthquake of May 9th last, and succession of tidal waves which occurred, commencing about a quarter of an hour or twenty minues afterwards, and continuing until late in the day on the 10th. At about half past five P.M. of the 9th, or three hours before the earthquake, the pivoted reflector employed in the office of the Submarine Telegraph Company in this city turned suddenly round, and persisted in such a manner in maintaining this reverse position that the operator at work at the time had to reverse it (by turning the little hollow metallic plug it is swung in on its center) to be able to continue his communications.

The highest of the waves here did not exceed twenty feet, its mark having been left at about that height above the level of the water in a salt water well close to the beach; but it is said to have reached the height of sixty feet at Pabellon de Pica, and also, I believe, the port of Megillones, in Bolivia. I do not, however, place perfect reliance on these reports.

New Agricultural Devices.

An improved Baling Press for baling cotton, hay, and similar articles, devised by Mr. Solomon S. Laird, of San Obispo Cal., embodies a powerful mechanical arrangement. Upper and lower pawls actuated by levers alternately engage ratchet bars and cause a follower to move forward. Then, when the bale is sufficiently compressed, it is tied and forced out at the end of the press by continuing the movement of the levers.

A new Farm Gate, by Mr. Malcom J. McPherson, of West Campbell, Mich., may be raised vertically before being turned on its hinges, to clear it from snow or other obstructions. It also may be raised and fastened without turning, so as to allow small animals to pass under it, while the escape of large cattle is prevented. Useful for pasture lots.

A Roof and Stock Pen for Platform Scales, by Mr. Adam E. Karsner, of Florida, Ohio, includes a structure which covers the platform scales and protects it from the weather. The pen may be arranged to receive stock when being weighed, and it may be turned back when loads of hay, etc., are put upon the scales.

A new Cotton Harvester has been invented by Mr. William J. Powell, of Marshfield, Mass. As the machine is drawn forward over a row of cotton plants, aprons are rotated and wire teeth thereon remove the ripe cotton and deliver it to boxes. One set of aprons work on the sides, another on the top of the plants, and they may be adjusted as desired There is great demand for machines of this description, and the present device will, we think, be found well worthy of examination and trial by planters.

Mr. Mastin C. Randol, of Huntington, Tenn., has invented a novel Corn Planter, which may be adjusted to plant the seeds at any desired distance apart, and any desired amount in a hill. It opens the furrow, drops the seed, cultivates the soil on both sides of the furrow, covers the seed, and rolls the ground.

For Stretching Wire Fence, Mr. Hubert Schülgen, of New York city, attaches a U-shaped clamp to each wire. In connection with this there is a winding up roller, turned by a key and locked by recesses in the clamp binding on an inclined projecting tooth of the roller. This is a simple and effective contrivance for extending wires of trellises for vines.

A very convenient form of Butter Package, which may be commended to the notice of dairymen, has been devised by Mr. George Kater, of Northville, Mich. It consists of a cylindrical wrapper of wood with overlapping edges, which is prevented from opening by detachable top and bottom covers. Within is a loose partition wall for separating the prints.

A new Harness for Breaking Horses, which is so constructed as to enable the operator completely to control the horse without being liable to injury himself, is the invention of Mr. Charles H. Bowin, of Rocheport, Mo. Ropes are connected with the fore and hind legs, and so arranged that the animal may be easily thrown upon his belly. The harness prevents the horse from running, rearing, or kicking, and admits of his easy control.

The new feature in an ingenious Corn Planter devised by Mr. Alfred F. Hammond, of Berlin (Loramies P. O.), Ohio, is an arrangement whereby the same devices that press down and flatten the loose earth above the seed also act upon buffing and friction wheels that are pivoted to rods, by which the said slides are vibrated. Said rods are connected with the seed slide levers. The marking devices, transporting wheels, and hoppers are arranged in line.

Mr. William H. Mellon, of Fern Valley, Iowa, has devised a new Rotary Cutter for plows, which is so constructed that the sand cannot get into or wear its journal. An ingenious device is added for bending down weeds, grass, etc., so that they will be turned under and fully covered by the furrow slice.

Mr. Joseph P. Terry, of Lake City, Florida, has devised a new Plow and Cultivator, the novel features in which are as follows: The shanks of the curved iron standards are bent upward and laterally at right angles, and also provided with a lateral flange to adapt them to be secured to the beams. The beams are three in number, and one of them is hinged to adapt it to be set at an angle to the others.

Those of our readers who may desire further information concerning any of the above described inventions, can obtain the same by communicating with the inventors at the addresses named.

Manganese Bronze.

Manganese bronze, the new alloy, has been found to greatly exceed in tensile strength both Muntz or yellow metal and gun metal. At recent experiments made at the Royal Gun Factories, England, a cold rolled rod was found to have remarkable strength, sustaining a strain of 34 tons before stretching, with an ultimate strength of nearly 40 tons per square inch, and an elongation of 11·6 per cent, of its length places it on a level, and, in respect of its elastic limit, above the best steel used for constructive purposes. The weakest quality is 50 per cent stronger than Muntz metal, and at the same time sufficiently ductile to be rivetted cold. It has been successfully converted into sheets and plates, wire and tubes, in all of which forms it possesses a great superiority over brass, being twice as hard and twice as strong. The *Engineer* says that the greatest heat it is likely to be subjected to in a locomotive, or other high pressure boiler, does not in the least reduce either its strength, toughness, or hardness, so that it would appear particularly suitable for boiler and condenser tubes.

Damages of Illuminating by Gas.

Professor A. H. Church states, in the *Chemical News*, that the injurious influence of the products of combustion of coal gas upon the leather bindings of books is only too well known. Vellum seems unaffected; morocco suffers least; calf is much injured, and Russia still more so. The disintegration is most rapid with books on the upper shelves of a library, whither the heated products of combustion ascend, and where they are absorbed and condensed. By comparing specimens of old leather with specimens of new it is quite clear that the destructive influence of gas is due mainly to its sulphur. True there are traces of sulphates in the dye and size of new leather bindings, but the quantity is insignificant, and there is practically no free sulphuric acid. That leather may be destroyed by the oil of vitriol produced by the burning of gas in a library is proved by the following observations and analysis:

The librarian of one of our public libraries forwarded to me the backs of several volumes which had been "shed" by the books on the upper shelves in an apartment lighted by gas. The leather of one of these backs (a volume of the "Archæologia") was carefully scraped off so as to avoid removing any paper or size from beneath. This task of scraping was easy enough, for the leather was reduced to the consistence of Scotch snuff. On analysis of the watery extract of this leather the following figures were obtained: Free sulphuric acid in decayed leather, 6·21 p. c.; combined sulphuric acid in decayed leather, 2·21 p. c.; total, 8·42 p. c.

Iodide of Starch.

The iodide of starch is a definite compound, its composition being represented by the formula $(C_{12}H_{10}O_{10})_3I$. It is decomposed, with regeneration of the original starch, by all sources of nascent hydrogen, and is again produced by the limited action of oxidizing agents in the cold, even by the mere action of the atmosphere. Except when present in excess, iodine is not eliminated by its solvents, such as potassium iodide, benzol, carbon bisulphide, etc., except alcohol, whilst these solvents separate it from the red compound which it forms with dextrin *a*. If kept suspended in water for a year it is slightly decomposed; a portion becomes soluble in water, which then contains dextrin *a*, colored red by iodine, and hydriodic acid, but no glucose. The insoluble portion retains the same composition.—*M. Bondonneau.*

Solidification of Carbon Bisulphide.

M. Mercier finds that if bisulphide of carbon be added to a mixture of a drying oil and protochloride of sulphur at the moment of mixing, it is entangled in the jelly formed by the oil and protochloride. With boiled linseed oil and ten per cent of the protochloride a transparent elastic mixture can be obtained containing 70 per cent of bisulphide of carbon. The substance ignites only with difficulty, and loses the contained bisulphide but slowly.

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THE CURIOUS LIFE-HISTORY OF OUR BLISTER BEETLES.

BY PROFESSOR C. V. RILEY.

Along with the honey bee, the silkworm, and the cochineal, the Spanish fly, or cantharis, ranks among the insects most useful to man. Everyone is familiar with this last insect, as it is found in our drug stores, and with its blistering properties; but the fact is not so well known that we have in this conntry several allied species which have the same valuable vesicatory property. Their curious habits in the preparatory stages formed the subject of a recent communication of mine to the St. Louis Academy of Science, the substance of which I propose to lay before the readers of the SCIENTIFIC AMERICAN in two papers, first narrating what has been made public of the habits of the family, and afterwards what has been recently discovered by myself.

The larval habits of the European cantharis of commerce, as also those of its congeners in our own country and other parts of the world, have remained a mystery, notwithstanding the frequency with which the beetles occur, their great abundance at times, and their commercial value and interest. The same remark holds true of all the blister beetles in this country. Some of these species are very common in the United States, and quite injurious to vegetation, swarming at times on potato vines, beans, clematis, and other plants. Their great numbers and destructive habits make it all the more remarkable that so little has hitherto been discovered of their early life. Harris, who evidently had hatched the first larva of the ash-gray blister beetle (*macrobasis unicolor*, Kirby), says: "The larvæ are slender, somewhat flattened grubs, of a yellowish color, banded with black, with a small reddish head, and six legs. These grubs are very active in their motions, and appear to live upon fine roots in the ground; but I have not been able to keep them till they arrived at maturity, and therefore know nothing further of their history."

Latreille states that the larvæ live beneath the ground, feeding on the roots of vegetables, but the statement is evidently founded on conjecture. Ratzeburg, who well describes the method of oviposition of the European *cantharis vesicatoria*, and roughly figures the first larva, believed that it was a plant feeder in the immature state. Audouin, who studied the cantharides profoundly, making them the subject of his thesis in his medical examination, was obliged to confess that absolutely nothing was known of their larval history; and Mr. Wm. Saunders, of London, Ont., in a paper on the same subject, read at the 1876 meeting of the American Pharmaceutical Society, could add nothing more definite. Among the older writers, the opinion was general that, like their parents, the blister beetle larvæ were vegetable feeders.

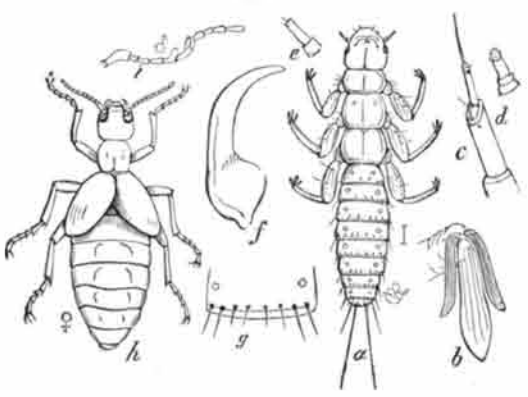
M. J. Lichtenstein, of Montpellier, France, has endeavored to discover the larval habits of the European species, and in 1875 he succeeded, after many fruitless attempts, in causing the first larva to feed on honey kept in glass tubes, and to undergo one molt. He afterwards kept two other specimens in the same way until they were nearly full grown.

These facts, as well as analogy, point to a parasitic life and partly carnivorous, partly mellivorous diet for our own common species, since the life-history of genera in the family, namely, *meloe*, Linn., and *sitaris*, Latr., has been fully traced. Indeed, the young of all the insects belonging to the *meloidæ*, which includes the blister beetles, so far as anything has yet been known of them, develop in the cells of honey-making bees, first devouring the egg of the bee and then appropriating the honey or bee-bread stored up by the same. They are all remarkable, in individual development, for passing through seven distinct stages, namely, (1) the egg; (2) the first larva or *triungulin*; (3) the second larva; (4) the pseudo-pupa or coarctate larva; (5) the third larva; (6) the true pupa; and (7) the imago.

HISTORY OF MELOE.

The history of *meloe*, popularly known as the oil beetle, may be briefly summed up as follows; The newly hatched or first larva (now generally called *triungulin* from its characteristic three claws to the tarsus), was first mentioned in

Fig. 1.



SITARIS:—*a*, triungulin or first larva; *g*, anal clasps and spinnerets of same; *b*, second larva; *e*, coarctate larva; *f*, third larva; *c*, pupa; *d*, female beetle—hair lines showing natural size.

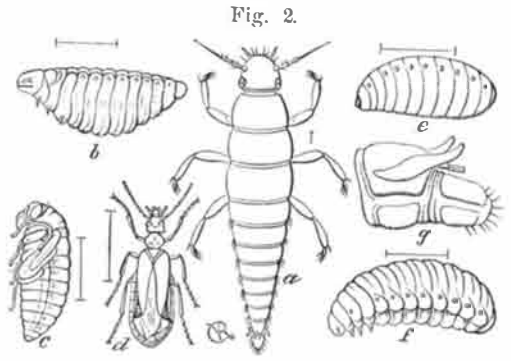
1700 by the Holland entomologist Gœdart, who hatched it from the egg. Frisch and Réaumur both mistook it for a louse peculiar to bees and flies. De Geer, who also obtained it from the egg, mentions it in 1775 as a parasite of hymenoptera. Linnæus called what is evidently the same thing, *pediculus apis*. Kirby, in 1802, described it as *pediculus melittæ*, and Dufour, in 1828, named it triongulinus andrenetarum. Newport, in 1845, first rightly concluded that it was carried into the nests of bees, and described in addition the full grown larva from exuvial characters, and the coarctate larva and pupa which he found in the cells of a mason bee (*anthophora retusa*). He failed, however, to fill the gap between the first and the full grown larva, and this Fabre first did, inferentially, in 1858, by tracing the analogous stages in sitaris.

The female *meloe* is very prolific. She lays at three or four different intervals, in loose, irregular masses in the ground, and may produce from three to four thousand eggs. These are soft, whitish, cylindrical, and rounded at each end. They give birth to the triungulius which, in a few days after hatching—the number depending on the temperature—run actively about and climb on to Composite, Ranunculaceous and other flowers, from which they attach themselves to bees and flies that visit the flowers. Fastening alike to many hairy Diptera and to Hymenoptera which can be of no service to them, many are doomed to perish; and only the few fortunate ones are carried to the proper cells of some *Anthophora*. Once in the cell, the triongulin falls upon the bee egg, which it soon exhausts. A molt then takes place and the second larva is produced. Clumsy and with locomotive power reduced to a minimum, this second larva devours the thickened honey stored up for the bee larva. It then changes to the pseudo-pupa, with the skin of the second larva only partially shed; then to a third larva within the partially rent pseudo-pupal skin; and finally to the true pupa and imago. These different changes of form are known by the name of Hypermetamorphoses, the term first given them by Fabre to distinguish them from the normal changes from larva to pupa and imago, experienced by insects generally.

HISTORY OF SITARIS.

The history of *Sitaris* is also well known, and agrees very closely with that of *Meloe*. The complete life history of the genus was first given by Fabre in 1857, who studied the *S. humeralis*, Fabr., while that of *S. colletis*, V-M, has been more recently given by Valery-Mayet of Montpellier, France.

Fig. 2.



MELOE:—*a*, triungulin or first larva—hair-line showing natural size; *b*, its claws; *c*, antenna; *d*, *e*, palpi; *f*, mandible; *g*, lower border of an abdominal joint; *h*, female beetle; *i*, antenna of male.

The first larva, or triungulin (Fig. 2, *a*), agrees very much in the head, tarsal and general characters with that of *Meloe*, but differs in several important particulars, and especially in having a pair of pre-anal spinnerets, from which is secreted a serous, sticky fluid which aids the animal in holding firmly to the bee that is to carry it into the nest. The hypermetamorphoses are very similar to those of *Meloe*. The The triungulin, after absorbing the contents of the bee egg, molts, and thereafter floats upon and devours the honey; the the pseudo-pupa, third larva, and true pupa all forming in due time with the second larval skin. The female does not feed, and on account of her heavy abdomen, travels but a short distance from the bee burrows where she developed.

Test on the Covering of Steam Pipes.

The building committee having in charge the erection of the several structures on the Trinity College site, at Hartford, Conn., recently instituted on the premises some experiments with materials at present extensively used for covering of steam pipes, whereby radiation of heat is prevented and condensation and freezing prevented. As there are about 8,000 lineal feet of pipe, varying in diameter from two to six inches, in the buildings, the question regarding the best and most suitable non-conducting material for this purpose became an important one. After the reception of tenders by competing firms for the covering of the pipes, it was deemed best to make an exhaustive test upon a portion of the pipe. Accordingly samples of pipe covering were put on by the following companies: The H. W. Johns' Manufacturing Company, the Asbestos Felting Company, the United States and Foreign Salamander Felting Company, and the Chalmers-Spence Company, all of New York.

The samples were placed around a six inch pipe to the satisfaction of the respective parties. A wooden box was constructed with an open bottom and two of the sides cut in a semicircle to fit closely to the covering. A light of glass was fitted in one side of the box, through which a thermom eter could be seen suspended from the top until it hung within an inch of the pipe covering. This done, all cracks or openings were securely fastened up so that the box was perfectly airtight. The H. W. Johns Company's covering consisted of one and a half inches of asbestos mixed with other ingredients, upon a lining of heavy felt paper laid next the pipe. During thirty minutes in which this test was made the thermometer rose from 97° to 103°. The Asbestos Felting Company's covering, two inches in thickness, was next tried, and in ten minutes the thermometer rose from 97° to 102°, and in half an hour from 97° to 105°. The patented "Air-space" covering of the Chalmers-Spence Company was next tested. This, as the name indicates, is a method of covering by which a dead air chamber is formed between the covering and the surface covered. This air space is formed in the following ingenious manner: Heavy wire cloth is used, to which is fastened every four or six inches a stud one inch or more in length. The wire cloth is then placed over the surface to be covered, the studs keeping it at the proper distance. Plastic covering is then applied to the thickness of half an inch, and this partly penetrates the meshes of the wire cloth and keys itself, thus giving a strong durable hold. The second coat of plastic is then applied and finished smoothly. At this test the thermometer did not rise above 94°, the time allowed being thirty minutes. A test was also made of the "plain" covering made by the same firm. This consisted of one and a half inches of the composition used in the first method, without the air space. During thirty minutes when it was tested the thermometer rose from 97° to 102°. On the application to the Salamander covering, consisting of one and a half inches of cement, the thermometer rose from 97° to 102°. All the the above tests were made under a pressure of ten pounds of steam. A synopsis of these trials, as communicated to us, is as follows:

Covering.	Test commenced when thermometer reached	Rose in 30 minutes to
H. W. Johns' Manufacturing Co.....	97°	103°
Asbestos Felting Co.	97°	105°
U. S. and Foreign Salamander Felting Co...	97°	102°
Chalmers-Spence Co.'s "plain".....	97°	102°
Chalmers-Spence Co.'s "air space".....	90°	94°

During the test the method employed was to watch the thermometer inside the box until it indicated a temperature of 97°, when, after leaving it in for thirty minutes, the temperature was again noted. But in testing the "air space" covering the temperature was so much less than the others, that after waiting until the thermometer indicated 90° it was found that it would not reach over 94°, although left in over one hour.

It was thus demonstrated that the "air space" covering showed the best results, and the contract was accordingly awarded to the Chalmers-Spence Company.

On the Manufacture of Plaster Casts.

BY J. J. MERTINS.

There are two little points which require special care in casting plaster of Paris: one is greasing the article to be moulded, and the other is stirring up the gypsum with water. For the first purpose it does not require a penetrating fat, but one that remains on the surface and covers it. In making the paste, water must not be poured upon the plaster of Paris, but the latter must be strewn in as loose condition as possible upon the water until the plaster reaches the surface of the water, and then quickly stirred together. The substance employed to oil the moulds is prepared by adding some fatty oil, generally lamp oil, to a solution of soap in water; this is called "smear."

If, for example, a rosette 12 inches in diameter is to be cast on a 4 inch high rim, the following method is employed. The pattern made by the artist in gypsum must be repeatedly coated with shellac solution, to prevent, as much as possible, the oil from penetrating and make it easier to separate the casting from the model.

The wedge-shape pieces that are to form the vertical part of the rosette are cast first and are three in number, a strip of clay being used to form three sides of the first one, two sides of the second (for a side of No.1 forms one side of No. 2), and one side of the third, for this is bounded on two two sides by Nos. 1 and 2.

Each part of the mould must be varnished and greased or oiled before a second part is cast in contact with it, to insure separation when dry. The surface of the model is again carefully oiled and a cast made of the whole model without taking away the side pieces, but making a fresh wall of clay close about the model. To preserve the necessary sharpness and avoid bubbles, and bare places, the first layer of plaster poured upon the model should be as thin as possible, and a soft pencil be employed to remove bubbles and bring it into contact with the edges and cavities. Thick plaster is next poured upon this and finally the thick sediment can be scraped out upon the cast and smoothed off. In a short time it can be removed from the model, the side pieces taken apart, and all carefully dried. Before making a cast from this mould the separate parts are placed together, after oiling, backed up and adjusted with clay walls, etc.

The Coquito Palm.

In Chili a sweet syrup, called *miel de palm*, or palm honey, is prepared by boiling the sap of the *jubœa spectabilis* to the consistence of treacle, and it forms a considerable article of trade, being much esteemed for domestic use as sugar. The sap is obtained by the very wasteful method of felling the trees, and cutting off the crown of leaves, when it immediately begins to flow, and continues to do so for several months, until the tree is exhausted, providing a thin slice is shaved off the top every morning, each tree yielding about 90 gallons. The small nuts, which resemble miniature cocoanuts, are used by the Chilian confectioners in the preparation of sweetmeats, and by the boys as marbles.—*Journal of Applied Science.*

TO REMOVE rust from steel, cover the metal with sweet oil well rubbed in; 48 hours after rub with finely pulverized unslaked lime.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion.

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Reliable information given on all subjects relating to Mechanics, Hydraulics, Pneumatics, Steam Engines, and Boilers, by A. F. Nagle, M.E., Providence, R. I.

Notes & Queries

(1) J. L. L. asks for rules for constructing the body of a microscope, to be 10 or 11 inches in length, to be like that furnished (as far as proportions and make is concerned) with so-called student's microscopes, and to be used with any objectives? A. There are no standard rules for the diameter of the body of the microscope, bnt the makers generally adopt a tube about 1 inch to 1½ inches in diameter. The tubes are either made of heavy sheet metal over a steel mandrel, or cast and finished in the lathe. The best plan is first to procure the eyepiece, and then make the body to allow the eyepiece to fit the upper end of it. At the lower end of the body have a collar with a screw for the object glass. The mountings of all first class English and American object glasses are now made with the screw of a standard size, which originated with the London Microscopical Society, and is known as the society screw.

(2) B. K. D. says: If I take a tank and fill it partly with water, then force air up and through the water, drawing it off at the top, will this air have the same proportion of oxygen as the air naturally held in water? Or will it still have the same, 1 part oxygen to 4 of nitrogen, as before entering the water? A. No. Oxygen is more soluble in water than nitrogen, and, consequently air forced through recently boiled (but cold) water will be found less rich in oxygen than before. If the water is aerated under pressure (by which the solubility of gases is augmented), when the pressure is relieved, the air escaping from the water will be rich in oxygen. By repeated solution in this way nearly all of the nitrogen may be removed.

(3) D. H. S. says: Will you please give me a recipe for something (besides lime, protosulphate of iron and sawdust) for purifying coal gas? I have also trouble to free the gas from tarry matters, which pass through the scrubber to the purifier. A. From what you say we judge that the trouble is not so much with your purifiers as with the washer and scrubbers. Water, good slaked lime, and hydrated ferric oxide are about the only purifiers in use. A larger main, better washing and greater surface, and the scrubbers will no doubt remedy the evil.

(4) J. F. E. asks how he can keep the water in an aquarium free from dirt? A. The only remedy will be to use purer water, or to renew frequently.

(5) C. P. advises C. H. C., who asks how to remove lime from cistern water, to try the addition of hard spring water. The lime is generally derived from poor cement used in the lining.

(6) In reply to E. H.—The paint will answer very well for some purposes, but does not compare with good quality Venetian red in color. It cannot be improved much by heat.

(7) J. E. F. says: I have been using artificial teeth for about 3 years. The plates are made of the material commonly used, a gutta percha composition made nearly the color of the natural gums. About a year ago the plates commenced to grow dark. What is the cause of the discoloring, and please give me a recipe for cleaning them? A. The plates are usually made of vulcanized rubber colored with vermilion. The change of color may have been due to sulphur compounds brought frequently in contact with it, in medicines or otherwise. Try fine emery powder, applied with a splinter of soft wood. If this fails, make a strong solution of iodide of potassium in water, add to it a few drops of hydrochloric acid, and apply, with care not to soil the teeth; then rinse with a little alcohol and wash in plenty of water.

(8) F. W. W. asks for a recipe for washing powder? A. Take sal soda, 12 parts; good quicklime, 5 parts; powder, mix, and keep in covered stoneware jars, or in bottles for use.

(9) C. B. asks (1) for a good cement for lining the inside of a galvanic battery trough, made of wood. The fluid used will be diluted sulphuric acid, 1 part acid to 10 parts water, also bichromate of potash, sulphuric acid, and water in the carbon compartment? A. Melt together equal parts of gutta percha and pitch; apply this hot. Or use a solution of caoutchouc in carbon disulphide mixed with 6 per cent of absolute alcohol; give several coats. 2. What would be the resistance of 150 feet of copper wire No. 14 (Brown and Sharpe gauge) be? A. If of good copper, about ·40 ohms under ordinary circumstances—less in cold and more in warm water. 3. In electrical measurement, what is the difference between 1 volt and 1 ohm? A. The ohm is the unit of electrical resistance, and is equal to the resistance of a prism of pure mercury, one square millimeter (=0·001549 square inch) section and 1·0486 meters (=41·2818091 inches) long, at 32° Fah. The volt is the unit of electromotive force, which varies little from the electromotive force of a standard Daniell's cell.

(10) Electric subscriber asks: What solution and quantities thereof is best for generating electricity with carbon or zinc in the same jar or cell without using the porous cup, and if sufficient strength to run a dwelling annunciator of 4 or 6 magnets with 5 cells of 1 gallon each? A. Amalgamate the zinc, and use water mixed with about 5 per cent of sulphuric acid. Six cells should be amply sufficient. The Leclanché cell is now generally preferred for annunciators.

(11) H. H. finds cracks in his stove and asks if there is any cement which can be used to fill them? A. Yes, make and apply a paste of finely pulverized iron (obtained at the druggist's) and water glass. The hotter the fire, the more the cement melts and combines, and the more completely the crack becomes closed.

(12) A. G. says that small metal fancy articles, which are in show cases, become rusted easily and lose their polish. Is there any way of protecting them? A. See that the cases are moderately tight, and keep in each a small lump of quicklime in a saucer.

(13) J. S. asks how to drill a hole in a china plate? A. Use a copper drill and emery moistened with spirits of turpentine.

(14) G. A. asks how to cut battery carbons? A. Use a hand saw moistened in water.

(15) W. B. asks whether paraffin candles can be dyed with aniline colors? A. Yes.

Is there any difference in strength of timber from different sides of the same tree? A. It is said that the strongest side of the tree is that which in its natural position faces the north.

How can I keep my fish net from rotting? A. Steep in melted paraffin, or boil in decoction of oak bark.

(16) F. H. B. asks what plaster moulders use to cover the insides of moulds? A. Lard and oil mixed. Glycerin is also said to be good.

(17) A. P. C. inquires how to find the speed of a belt in feet per minute? A. Multiply the diameter of either pulley in feet by 3·1416 times the number of revolutions that it makes per minute.

(18) E. T. asks: What mordants are commonly employed in dyeing with sumac? A. Either tin, acetate of iron or sulphate of zinc. The first gives yellow, the second gray or black, according to the strength, and the third greenish yellow.

(19) J. N. B. asks (1) if sumac leaves are substituted for bark in tanning leather? A. Yes; for some kinds. 2. How are the leaves prepared? A. The leaves are thoroughly dried, and ground to a fine powder 3. Where can a market be found? A. The chief market is New York city.

(20) W. B. P. asks: What can I do for my lips to make them tough so they will not chap? A. Apply twice a day a lotion of borax, 2 scruples: glycerin, ½ oz.; water, 7½ ozs.

What will restore the ivory mouthpiece of my flute to its former whiteness? A. Brush over with pumicestone and water and expose to the sun under glass until bleached.

(21) J. E. W. asks for a recipe for cleaning marble that has become rusty or mossy by exposure to the weather, and which will not injure the stone? A. Mix up a quantity of the strongest soap lees with quicklime to the consistence of milk, and lay it on the stone for 24 hours; clean it afterwards, and it will appear as new.

(22) S. W. L. asks: 1. What size wire would be required to convey an electric shock sufficient to kill a horse, or other large animal, and would a number of small wires, aggregating the same size, be preferable to a single large wire? A. No. 16 Brown and Sharpe's gauge. Yes, if it is likely to be bent or twisted. 2. What size battery would be required to produce the shock, and would it matter if the jars were covered so as to prevent spilling if upturned? A. It would require about 800 square feet of Leyden jar surface, or a very powerful induction coil, and battery. No.

1. What effect have air and water on rubber when it is exposed to their combined action? A. It destroys its elasticity. 2. In what thicknesses is good elastic rubber impervious to air? A. $\frac{1}{16}$ of an inch. 3. How can I estimate the horse power required to work an air pump which is to be used to keep a vacuum? A. Multiply the number of square inches of piston surface by 15, and by the number of feet it travels in a minute; divide this product by 3,300; the result will be the horse power required; to which one fifth should be added for friction.

(23) G. A. F. asks; What is chymogene, used for ice making, and how is it used? A. Chymogene is simply high gravity gasoline at about 110°. It passes with rigoline as the first product of petroleum distillation. See article on ice machine in this issue.

(24) J. T. W. asks: If the back motion eccentric rod of a locomotive is a little too short or a little too long (say ⅜ inch) what effect will it have on the valve in forward motion? A. None.

(25) A. F. W. asks how to zinc coat or galvanize malleable castings? A. Clean in sulphuric acid and water, wash, scour with cocoanut husk. Dip in melted zinc covered with sal ammoniac. Drain. Wash in cold water.

(26) S. R. H. asks: What can I clean brass shells with, such as are used in breechloading guns? A. 1 oz. oxalic acid, 6 ozs. rottenstone, ½ oz. gum arabic in powder, 1 oz. sweet oil, and enough water to make paste. Apply and rub dry with flannel.

(27) D. T. S. says: I have some silk covered copper wire which is bare in places; how shall I insulate it? A. Apply gutta percha dissolved in benzole or bisulphide.

(28) A. P. asks for a recipe for red printing ink, vermilion red? A. It consists usually simply of vermilion ground up with prepared linseed oil. To 6 quarts of boiled oil add 6 lbs. of rosin, and when this is dissolved add 1¾ lbs. of dry brown soap of best quality cut in slices. Then mix in and grind the pigment.

(29) F. S. asks how bronze is dyed on leather with anilines? A. Dissolve aniline violet in water and brush over the leather.

(30) E. B. R. asks how to clean plate glass? A. Try a strong solution of carbonate of potash.

(31) T. P. J. says: Will you please inform me concerning the *modus operandi* of the Mt. Washington railway? Is the track an ordinary one with the addition of a central rail, upon which a cog wheel on the engine works? A. The construction of the railroad is as you suppose. Very efficient means of stopping are provided, consisting of a pawl and ratchet, in addition to air brakes, and when descending, air is admitted into the cylinder of the locomotive, and the exhaust is controlled by the engineer, so that the train is regulated in this manner also. You will find a detailed account of the railroad in the *Proceedings of the American Society of Civil Engineers*, vol. 3, p. 12.

(32) K. L. D. asks for a cement which will withstand the effects of hot water; the cement to be used for uniting pieces of a porcelain vessel. A. Quick lime mixed to a cream with white of egg.

(33) A. D. B. E. asks how a room 40 by 14 without the agency of steam heating, in the most economical way can be made into apartments for Turkish baths, so as to answer the purpose? A. A water heater, such as is used on many railroad cars, will answer the purpose.

(34) T. L. C. asks how to make a soap that will remove grease, etc., from silk or woolen goods without removing the color? A. Aqua ammonia 2 ozs., soft water 1 quart, saltpeter 1 teaspoonful, shaving soap in shavings 1 oz. Mix.

(35) C. M. S. says: Will you inform me how many lbs. of No. 32 cotton-covered copper wire it would take to construct a machine capable of giving an electric light; the machine to be run by an engine and to be similar to Gramme's? A. About 25 lbs. of No. 32 wire, but this size, being so fine, would require an especial winding to adjust the necessary relative resistance of the armature and magnet. It would be better and less expensive to use 17 lbs. of No. 20 for the magnet, and 8 lbs. of 32 for armature.

(36) H. W. B. says: In a discussion relating to the safety of lightning rods, it was claimed that no rod, that is considered a good conductor, could detract the thunderbolt from its course, even if it did fall within the space equal to that of a circle described with the height of the rod as radius, and that the rod might possibly save the house if the bolt happened to strike the rod; it was claimed that if the bolt was "headed" toward a certain point it would go there, regardless of all rods, conductor, etc., even if the said point was within ¼ inch from a rod. I claimed that the rod protected a space equal to the circle, with the hight of the rod as radius, and that if a bolt was coming towards any point within this circle it would be changed from its course and conducted down the rod. A. It is generally estimated that a properly constructed lightning rod protects an area whose radius is double the height of the rod extending above the structure. This rule is not now, however, considered very reliable, by reason of the extensive use of gas and water pipes in dwellings. When electricity finds several paths it will prefer the best, it is true; but some portion will also pass along the poorer conductors. It is a good plan to connect all pipes and metal work of any extent in the building with the rod. The rod offers most efficient protection to buildings by discharging silently the accumulated electricity at the earth's surface, thus, in great measure, preventing the possibility of a disruptive discharge from the clouds.

(37) G.M. asks for a good method of dyeing silk seal brown? A. For 10 yards—Boil fustic 1 lb., logwood 3¼ ozs., cudbear 2½ ozs. Cool to 200° Fah.; enter and winch for 20 minutes, air out, repeat: sadden to pattern with 4 ozs. copperas; wash and dry.

(38) A. S. says: Please tell me the difference in the pressure of water in an upright tube 33 feet high and 1 inch in diameter, and a tube 2 feet high and 6 inches in diameter? A. If you mean the pressure per square inch on the base, it will be in direct proportion to the height of column, and you can estimate that each inch of height corresponds to a pressure of about 0·036 lbs. per square inch.

(39) I. N. D. says: 1. What kind of water wheel should I use for a water power of 3 feet head and 4,000 cubic feet per minute, having reference more to economy in building than extreme economy in the use of water? A. A breast wheel will answer. 2. How can I convey such power to a distance of 80 feet at an angle of 30° up, having in view economy of construction as much as saving of power? A. You can use two universal joints. 3. If I should use a breast wheel, what would be the proper diameter, and length and size of buckets, and what percentage of the power due to such head and quantity of water, under such conditions, could I expect to realize? A. Professor Rankine gives the following data in his "Treatise on the Steam Engine, and other Prime Movers," which you may consult for further particulars. Efficiency of breast wheels, 70 to 80 per cent. Ordinary velocity for outer surface of wheels=6 feet per second. Q=cubic feet of water discharged per second. w=surface velocity of wheels in feet per second. r=radius of wheel in feet. b=depth of bucket, from 1 to ¾ feet; length of buckets in feet $= \frac{3Q}{2wb\left(1-\frac{b}{2r}\right)}$

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges with much pleasure, the receipt of original papers and contributions upon the following subjects:

On the History of Coal. By R. P. S.
On Curious Blood Disks. By J. M.
On Our Thrushes. By E. I.
On the Torpedo Balloon. By F. P.

HINTS TO CORRESPONDENTS.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

WANTS AND BUSINESS INQUIRIES.

Almost any desired information, and that of a business nature especially, can be expeditiously obtained by advertising in the column of "Business and Personal," which is set apart for that purpose subject to the charge mentioned at its head.

We have received this week the following inquiries, particulars, etc., regarding which can probably be elicited from the writers by the insertion of a small adver-

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tisement in the column specified, by parties able to supply the wants:

Where can I obtain English steel stamps with two shears?

Who manufactures dynamite?

Who makes engines for propelling steam plows?

Where can felt cloth be obtained, suitable for rubbing crayon marks from blackboards?

OFFICIAL.

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AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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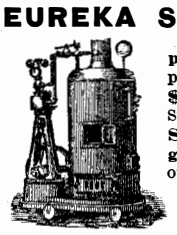

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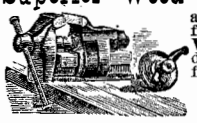

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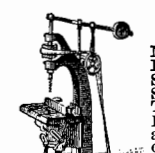

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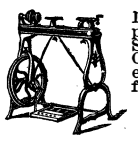

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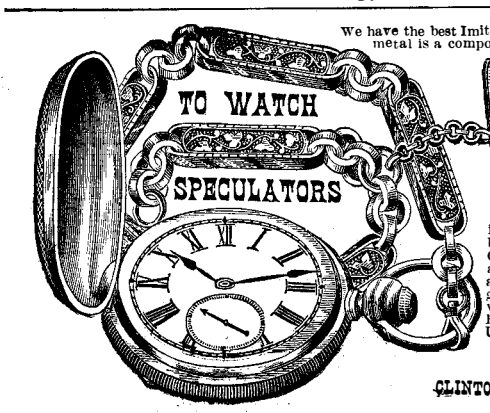

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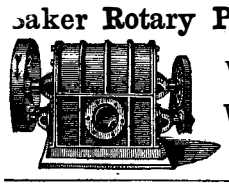

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REPORT

OF THE

Superintendent of the Insurance Department

OF THE STATE OF NEW YORK,

ON THE

EXAMINATION

OF THE

New York Life Insurance Company,

OF NEW YORK CITY.

INSURANCE DEPARTMENT, Albany, October 24th, 1877.

The Superintendent having personally, and through the services of the Deputy Superintendent, aided by the force of the Department, commenced and completed a searching examination into the affairs of the NEW YORK LIFE INSURANCE COMPANY of the City of New York, it affords him unqualified pleasure at being able to announce and make public the gratifying fact that the result of this examination is most satisfactory, and that, from the data in possession of the Department, the solvency of this, or other companies undergoing a similar test, can be readily ascertained, at little expense, for many years to come.

This Company was organized in 1845, and no investigation having been made, either by the Department or other properly constituted public authority, prior to the date when the department was formed, much time has necessarily been expended to bring the matter to a conclusion.

The services of forty-one gentlemen of character, standing, and experience, have been procured, who have valued and appraised the property situated in forty counties in this State and in the State of New Jersey, covered by 2,629 mortgages amounting to $17,354,847.84, and forty-nine pieces of property owned by the Company amounting in value to the sum of $2,541,576.46; which services have been intelligently and efficiently performed. The abstracts of title to each and every piece of these large amounts of property have been closely examined and reported on to the satisfaction of the Superintendent. All other investments, amounting to $10,311,045.67, have been carefully looked into, and evidence of payment by the Company, either by check or otherwise, for such investments, demanded and given, although many of these payments were made twenty years ago. The cash securities of the Company, the cost of which on the books amounts to $9,730,529,91, are of the most unexceptionable character, and are worth $580,515.76 more than cost.

The Superintendent personally examined these securities, taking the letter, number, and denomination of each security, and preserving the record of the same in the Department. In every instance where securities had depreciated in value, such depreciation had been promptly charged to profit and loss account, and all items of doubtful character had been stricken off by the Company from its assets, and omitted from its reports. Complete seriatim lists of policies, premium loans, and uncollected and deferred premiums have been made, and are on file in the Department.

LIABILITIES.

Every item of liability, real and actual, or contingent, as sworn to by the officers in the last Annual Report made to the Department, a copy of which is herein embraced, has been closely scrutinized, and the statements in said report found to be true to the letter, and no other liabilities were found to exist.

MISCELLANEOUS.

The different Departments—Medical, Actuarial and Agency—have been reviewed, with the most satisfactory results—gentlemen entirely competent and assiduous having been found in charge of each branch, to whose conduct and performance of their duties much is due.

Agents collecting funds of the Company at different points are held to a rigid accountability, remittances being required at the larger points tri-weekly, while at the smallest points settlements are not allowed to be delayed longer than a week. Bonds are required where the sums handled are sufficient to justify the same.

The system of book-keeping adopted by the Company, after many years of experience, seems to be perfect—the checks of one division on another being so complete, that no wrong can be done to policy-holders by false entries of any kind short of wide-spread collusion among many employés, all of whom were found to be exceedingly courteous, and, acting under instructions from the principal officers of the Company, were prompt in furnishing full information as to every detail.

Judged by the hardest test that could be applied under the law, and with every doubtful item eliminated from their sources, the net surplus, as shown by the detailed statement of this Company, which follows, amounts to $5,962,878.79.

This exhibit clearly establishes the fact that where a Life Insurance Company is honestly, ably, and prudently managed, there is no occasion to force a showing of solvency by including in its assets prospective value of real estate, and excesses of premium payments to be received.

For the reasons above given, the Superintendent has no hesitation in stating that this great Corporation is entitled to public confidence and its officers to his warmest commendation.

ASSETS.

	Cost Value.	Market Value.	
Real Estate			$2,473,087.50
Bonds and Mortgages			17,205,232.84
Stocks, Bonds, etc., owned by the Company:			
Merchants Bank, N. Y., stock	$15,758.75	$16,100.00	
Bank of America, N. Y., stock	8,484.00	10,164.00	
Bank of the Republic, N. Y., stock	1,470.00	1,470.00	
American Exchange Bank, N. Y., stock	10,125.00	10,500.00	
Metropolitan Bank, N. Y., stock	5,381.25	6,400.00	
United States Bonds	3,792,113.97	3,892,763.34	
Central Park Loan	25,233.75	26,750.00	
Delaware and Hudson Canal Co., stock	44,800.00	44,800.00	
Delaware and Hudson Canal Co., bonds	400,000.00	400,000.00	
New York Street-Opening bonds	549,967.10	576,110.00	
New York County Bounty Bonds	41,104.00	42,000.00	
New York City consolidated bonds	645,596.25	745,875.00	
New York County consolidated bonds	113,928.75	131,625.00	
New York City (Morrisania and West Farms) bonds	60,000.00	60,000.00	
New York Central and Hudson River Railroad, bonds	1,019,382.50	1,170,000.00	
New York and Harlem Railroad bonds	1,074,075.00	1,178,333.33	
Brooklyn City bonds	983,144.80	1,024,700.00	
Jersey City bonds	442,425.00	450,590.00	
Yonkers Town bonds	178,479.16	183,700.00	
Newark City bonds	129,875.00	131,210.00	
Flushing Water bonds	77,600.00	80,000.00	
Rensselaer and Saratoga Railroad bonds	9,519.92	10,155.00	
Eastchester bonds	5,000.00	5,000.00	
Richmond City bonds	46,250.00	56,500.00	
Tennessee bonds	8,000.00	8,000.00	
Georgia bonds	2,730.00	3,500.00	
Alabama bonds	15,840.00	15,840.00	
South Carolina bonds	8,960.00	8,960.00	
Mississippi warrants	15,285.71	20,000 00	
Totals	$9,730,529.91	$10,311,045.67	10,311,045.67
Premium Notes and Loans			$781,585.39
Cash in Banks and Trust Companies			1,427,933.18
Interest due and accrued on Bonds and Mortgages			224,052.75
Interest due and accrued on Stocks and Bonds			42,320.39
Interest due and accrued on Premium Notes and Loans			25,709.37
Rents due and accrued			8,476.17
Premiums due and unreported		$125,027.15	
Premiums deferred		432,695.40	
Total		$557,722.55	
Deduct 20 per cent. estimated cost of collecting above		111,544.51	
Net amount			$446,178.04
Total admitted assets			$32,945,621.30
ITEMS NOT ADMITTED:			
Agents' Balances		$36,154.19	
Cost value of Real Estate over present appraised values		68,488.96	
Loans on Mortgage in excess of present value		149,605.00	
Total			$254,248.15
Total Gross Assets			**$33,199,869.45**

LIABILITIES.

Death Losses and Matured Endowments not due	$418,393.19
Death Losses and Claims resisted	97,200.00
Premiums paid in advance	17,038.32
Estimated liability on Lapsed Policies	10,000.00
Net Re-insurance Reserve	26,440,111.00
Total Liabilities	$26,982,742.51
Surplus as regards policy-holders, on the basis of admitted assets as determined by this report	5,962,878.79
Surplus as regards policy-holders on the basis of total assets, as reported by the Company	6,217,126.94
Estimated surplus of Tontine policy-holders included in the above	517,504.84

JOHN F. SMYTH, Superintendent.

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From ¼ to 10,000 lbs. weight, true to pattern. An invaluable substitute for forgings, or for malleable iron castings requiring great strength. Send for circular and price list to CHESTER STEEL CASTING COMPANY, EVELINA STREET, PHILADELPHIA, PA.

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